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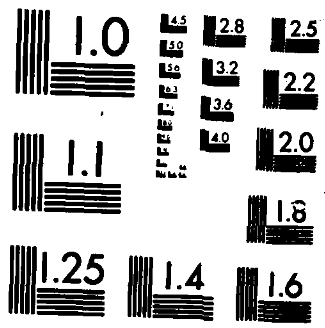

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The Force Level Automated Planning System (FLAPS) is a computer software package developed by Systems Control Technology Inc (SCT) for the United States Air Forces in Europe (USAFE). FLAPS applies powerful mathematical optimization algorithms, detailed mathematical models, and large data base files to automatically perform critical force planning functions for tactical air assets. Program overall design is aimed towards assisting force planning personnel usually found at Allied Tactical Operations Centers (ATOC) and Allied Tactical Air Forces (ATAF) command headquarters. This report documents the proof-of-concept system that was initially delivered to USAFE and, as a demonstration system, shows how modern mathematical optimization techniques and off-the-shelf computer systems can assist force planners in quickly generating operating plans with totally effective use of limited assets.

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FORCE LEVEL
AUTOMATED PLANNING
SYSTEM (FLAPS)

FLAPS USER'S MANUAL

FEBRUARY 1986

CONTRACT F61546-84-C-0088

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CONTENTS

CHAPTER IV FLAPS DATA STRUCTURES

APPENDIX B HOW TO RECOMPILE THE SOURCE CODE

APPENDIX C HOW TO BUILD FILES FROM SCRATCH

FLAPS GLOSSARY

AAA	Antiaircraft Artillery
ACCESSIBLE NODE	A node which can be reached directly from another node.
ACCESSIBLE NODES BOX	A rectangular area containing all of the nodes which can be reached from a given node. Used by the DPA when building arcs.
ACO	Airspace Coordination Order
AGL	Altitude Above Ground Level
ALTG	An array containing the optimal altitude of an aircraft above the ground.
ALTS	An array containing the optimal altitude of an aircraft above sea level.
ARC	Path between two nodes
ATAF	Allied Tactical Air Forces
ATM	Air Tasking Messages
ATO	Air Tasking Order
ATOC	Allied Tactical Operations Center
CL3D	The 3-dimensional Clobber array
COMPASS CALL	Airborne non-lethal electronic combat system
COOKIE-CUTTER TEMPLATE	A circular uniform threat lethality model.
CONTOUR MAP	Graphic displays of terrain heights, flight altitudes, roughness, slope, or danger. Lines are plotted to show regions of equal value at set increments.
CORRIDOR	A high probability-of-survival region created by applying threat suppression assets through which sorties will be routed.
DANGER	A quantitative representation of the threat to a penetrating aircraft at a location. Mathematically, the negative of the natural logarithm of the combined probability of survival per second.
DCL	DEC Command Language
DEC	Digital Equipment Corporation
DIALOG AREA	The part of the terminal screen where the user's commands are entered and data and messages from FLAPS are displayed.
DMA	Defense Mapping Agency
DOO	Daily Operations Order
DPA	Dynamic Programming Algorithm
DTED	Digital Terrain Elevation Data
EC	Electronic Combat

ENTRY LLTR NODE--------	The first LLTR node an aircraft will encounter upon leaving a staging base.
ENVELOPE---------------	A region defining the maximum extent of a threat. Because of terrain masking and other factors, some areas of the envelope can contain no danger from that threat.
EVENT------------------	The numeration of points along a route where "something happened," such as a turn point or a change in threat status.
EW---------------------	Electronic Warfare
EW/GCI-----------------	Early Warning/Ground Control Intercept Radar
EXIT LLTR NODE---------	The last LLTR node an aircraft will pass before crossing the FEBA.
FEBA-------------------	Forward Edge of Battle Area
FLAPS------------------	Force Level Automated Planning System Computer Program
GCI--------------------	Ground Control Intercept Area
ID---------------------	Identification, in FLAPS, ID usually refers to the alphameric name of some data object.
INACTIVE LLTR NODE-----	An LLTR node which is not available for use during the current planning cycle. The ACO determines which LLTR nodes are on and which are off.
INTERMEDIATE LLTR NODE-	Any LLTR node which is available for use during the current planning cycle, but which cannot be reached directly from a staging base and cannot directly access the FEBA.
LEG--------------------	A segment of a route between consecutive turn points.
LLTR-------------------	Low Level Transit Route
NATO-------------------	North Atlantic Treaty Organization
NODE-------------------	Significant route points which are joined together by the DPA to form arcs and then routes. Specifically, they are staging bases, LLTR points, and targets.
NODE INDEX-------------	A unique number corresponding to every active staging base, LLTR point, or target. They can be retrieved by showing the NLIS or NPOS arrays.
OCA--------------------	Offensive Counter Air
PA---------------------	Probability of Arrival of Penetrating Aircraft
PD---------------------	Probability of Destruction of Target
PK---------------------	Probability of Kill of Penetrating Aircraft
PS---------------------	Probability of Survival of Penetrating Aircraft
PRIMARY COMMAND--------	A FLAPS command designed to be used by a

mission planner.
RCS-------------------- Radar Cross Section
ROZ-------------------- Restricted Operating Zone
SAM-------------------- Surface-to-Air Missle System
SCALAR----------------- A data structure containing only a single element.
SCENARIO SPACE--------- The entire geographical region under consideration during a FLAPS session.
SCL-------------------- Standard Conventional Load
SCT-------------------- Systems Control Technology, Inc.
SECONDARY COMMAND------ A FLAPS command designed to be used by program developers. These will not normally be used by mission planners.
STALE DATA------------- Data generated using input partameters or data bases that have since been modified. (For example, routes generated using the statespace before it was modified.)
STAT------------------- The array containing the current statespace.
STATESPACE------------- Eight-directional grid collapsed from two or 3-dimensional dangers. Used to determine cost of travel from one cell to another.
STATESPACE CELL-------- A geographic and altitudinal region in which the probability of surviving threats has been quantified.
STOCHASTIC THREAT------ A mobile threat whose location is only approximately known with time.
SWITCH----------------- A data construct which provides the FLAPS program with information about how it is currently configured.
TAF-------------------- Tactical Air Forces
TAC-------------------- Tactical Air Command
TEKTRONIX 4115-B ------ The color graphics display for FLAPS.
TERRAIN FOLLOWING------ Air vehicle having constant clearance over terrain.
TERRAIN MASKING-------- Using the terrain to minimize danger.
TF--------------------- Terrain Following
THREAT MODEL----------- A data structure which contains generic information about a specific type of threat.
TH2D------------------- An array containing the 2-dimensional Threat environment data.
TH3D------------------- An array containing the 3-dimensional Threat environment data.
TOT-------------------- Time on Target
TREE------------------- Optimum sequence of LLTR nodes from each LLTR entry point to all LLTR nodes accessible from it.
USAFE------------------ United States Air Forces Europe
VAX-------------------- A line of 32 bit DEC computers

VAX 11/750 ------------ VAX (DEC) computer upon which FLAPS runs.
VECTOR----------------- A data structure which contains many elements.
VMS-------------------- An operating system for VAX computers
WAYPOINT--------------- A point on a route where one or more of the flight parameters change (for example, heading or altitude).
WILD WEASEL------------ Airborne Lethal Defense Suppression Weapons System
WFZ-------------------- Weapons Free Zone

CHAPTER I

INTRODUCTION

The purpose of this document is to describe the use of the Force Level Automated Planning System (FLAPS) developed by Systems Control Technology, Inc. Chapter I describes the purpose of FLAPS. The rest of the user's manual is a detailed description of the operation of the program. Chapter II contains an overview of the FLAPS commands and instructions on how to get started using the program. Chapter III provides detailed instructions on the FLAPS commands. The FLAPS data bases are very extensive because of the large amount of information that is needed to do force level planning. Chapter IV describes these data bases. Chapter V describes a number of examples that will help the user in building and running scenarios. Three appendices are included at the end of the manual. Appendix A explains how to set up and run the FLAPS software on a Digital Equipment Corporation VAX computer. Appenidx B explains how to recompile code. Appendix C explains how to build up the FLAPS files from scratch and contains listings of command files that either initialize one of the data bases or initialize the program.

It is the intent of this user's manual to provide USAF personnel with all the information they need to use FLAPS effectively. The overview in Chapter II and the example in Chapter V are very helpful in illustrating how the program should be used. Chapters III and IV should be used as references to answer specific questions about command options or items in the data bases. A user reading this manual for the first time should probably read Chapters II and V thoroughly and only glance over Chapters III and IV. The user should be able to answer any questions that come up while reading Chapter V by referring to Chapters II, III, and IV. In addition, the FLAPS program contains an extensive internal and on-line HELP feature. The user can use this feature to answer specific questions about FLAPS commands anytime during the execution of the program.

I.1 THE PURPOSE OF FLAPS

FLAPS is a stand-alone, proof-of-concept computer software package which automatically performs various force planning functions. The system has been designed to meet the requirements of USAFE planners operating in the central European theater. However, the models and data bases are flexible enough to allow the user to build scenarios anywhere in the world. The program is "stand-alone" in the sense that there are no automated interfaces to other existing computer systems or data bases. The user is responsible for preparing the data required to run FLAPS and to ensure that the data is in the proper format. The program is a "proof-of-concept" because it is not intended to be used operationally. Instead, FLAPS is a demonstration system which shows how modern mathematical optimization techniques and computer systems can assist planners in quickly generating operating plans which use limited assets in the most effective way possible.

I.1.1 The Force Planning Problem

Force planners, like those at a NATO ATOC, face a very complicated problem. The planner's overall objectives are stated in the Daily Operations Order (DOO) generated by the NATO ATAF. In particular, the planner must assign the available assets to targets specified in the DOO. Ultimately, the planner generates Air Tasking Orders (ATO's) and Air Tasking Messages (ATM's) that assign specific NATO attack aircraft to specific targets. ATO's and ATM's are issued to NATO support aircraft, in particular EW support aircraft and tankers. These aircraft are assigned to locations where they can support the penetrating attack aircraft.

Generating these ATO's and ATM's is complicated by many factors. First, the aircraft assets available to meet the objectives of the DOO are spread out over many staging bases. Each staging base has its own inventory of aircraft and weapons. When assigning assets from a particular staging base to a specific target, the planner must make sure that aircraft are available, that weapons appropriate to the target are available at the staging base, that the available aircraft can deliver those weapons, and that the target is within range of the aircraft. These constraints must be considered within the context of the Airspace Coordination Order (ACO), which restricts the way the penetrating aircraft can fly through friendly airspace.

In addition, the enemy threat must be considered to ensure that the assigned missions are survivable. In the 1985-1995 timeframe, and beyond, the fixed and mobile threats will be extremely dense, rapidly changing, and lethal. These threats must be considered and planned for if the penetrating aircraft are to safely reach their targets and return.

Fortunately, support aircraft are available which can reduce the capability of the threats and significantly increase the probability that the attack aircraft will safely complete their missions. The availabilty of these aircraft will affect the way the attack aircraft are assigned. In other words, the attack and support aircraft must be considered simultaneously if the total force is to be as effective as possible.

Finally, the planner is under time pressure to output the ATO's and ATM's. While data regarding the available assets and the locations of enemy threats are available, the planner may not have time to quantitatively analyze it. Without automated tools, gross approximations must be used.

I.1.2 The FLAPS Solution

Many of the problems discussed above are basically numerical. For example, the status of the force, i.e., the number of aircraft and weapons available at each staging base, is just a table of numbers. Performance data for attack aircraft, fuel flow, fuel capacity, etc., are available. Using these two data bases together, it is a straightforward process to determine if a target is within range of a particular staging base, and if the right type of weapon is available. While this is difficult and time consuming to do by hand, it is very simple to do on a computer. This is the approach used in FLAPS; data bases from multiple sources are integrated and data is processed in a way that systematically and quickly solves the planning problem.

The solution approach can be broken down into six steps. These steps are:

STEP 1 UPDATE THE DATA BASE.

STEP 2 DETERMINE STAGING BASE AND TARGET ACCESSIBILITY.

STEP 3 COMPUTE OPTIMAL INGRESS AND EGRESS ROUTES TO TARGETS.

STEP 4 ALLOCATE WEAPONS TO TARGETS.

STEP 5 ALLOCATE SUPPORT AIRCRAFT TO OPEN HIGH PROBABILITY OF SURVIVAL FLIGHT CORRIDORS.

(steps 3, 4, and 5 may be iterated)

STEP 6 OUTPUT ATO's.

The initial step (STEP 1) is to update the force status data, the current target list, the ACO, and the current threat status. Force status, target, and ACO data are stored in the FLAPS data base and are used continuously in the remaining five steps. The threat data is processed into a large file called the statespace array (STAT). This array is a summary of the entire enemy threat laydown. It is constructed using detailed models of threat system capability together with an efficient terrain masking algorithm. The next step (STEP 2) is to search the prioritized target list and determine which staging bases are in range of each target, and which of those staging bases have weapons effective against that target. Staging bases which are in range and have appropriate weapons are said to be "accessible." Force status data is included in the accessibility calculations. This includes the current inventories of aircraft and weapons at each staging base.

Once the data bases (including the statespace) have been calculated and accessibility has been determined, the "optimal" ingress and egress flight paths are computed. This is STEP 3. Optimal routes are generated for every target from every staging base accessible to that target, and back. Route performance data is calculated for each route. This data includes the probability of survival and the number of aircraft required to attack the target to reach the minimum damage threshold. This data is calculated for each route.

Using the accessibility and route performance data, FLAPS determines which staging bases should be tasked to each target. This is the weapons allocation step, or STEP 4. In general, several staging bases may be within range of a given target. FLAPS searches the route performance data for each of these staging bases and determines which staging base is most appropriate. This staging base is then allocated to the target. This is done for each target, in order of priority, until either the supply of weapons or of aircraft is exhausted.

Optimal routes are generated using the statespace together with a very fast and efficient dynamic programming algorithm (DPA). Routes are optimal in the sense that no other path between the staging base and the target will have a higher probability of survival. The ability to quickly generate these optimal flight plans, and to change the lethality of the enemy threat laydown (to change the statespace) is what gives FLAPS its power.

Up to this point, no electronic combat (EC) suppression has been applied, therefore, the routes for the penetrating fighters will encounter significant threat danger. The initial set of routes between the staging bases and the targets are available to assist the planner in deciding where to put the available EC suppression assets. The planner applies the EC suppression assets using a color graphics terminal. Graphic displays and reports are available to help the planner determine where EC suppression is required and where it will be most effective. After the planner has determined where the EC suppression should be applied, FLAPS updates the statespace to reflect the effectiveness of the EC suppression against the threat. Then the optimal flight paths are recalculated. Typically, the routes will change in order to take advantage of

the "high probability of survival corridors" through the forward edge of battle area (FEBA) that the EC suppression assets have opened up. Again reports and graphic displays are available to show the planner how effective this allocation will be in improving the probability of survival for the penetrating fighters. The planner may try several types of EC suppression allocations. The best allocation of weapons to targets, and locations for the EC suppression assets can then be output in ATO format.

The routes generated by FLAPS may not be exactly the same as the routes that are eventually flown. These routes are planned at the squadron. However, the planner knows that the information contained in the ATO that he has issued will provide safe corridors for the attacking fighters. The squadrons will know the locations of these corridors and should take advantage of them. The planner also knows that routes exist to the assigned targets that are within range, and which take maximum advantage of the available EC suppression assets. In this way, the planner (using FLAPS) can quantitatively analyze the threat and generate an ATO which assigns appropriate weapons to as many targets as possible and which maximizes the probability of survival of the penetrating fighters. FLAPS is very fast and efficient. The planner can solve the planning problem in a relatively short amount of time. This allows the planners to use more up-to-date data, to concentrate more on strategy, and to spend less time on bookkeeping tasks.

I.2 THE STRUCTURE OF FLAPS

FLAPS is designed to solve the force planning problem in the way described above. FLAPS is a command driven, interactive program. The commands are described in Chapters II and III. The major commands are shown below together with the appropriate steps in the planning process. This table helps the user relate the commands he issues in FLAPS to the planning problem to be solved.

STEP	COMMAND		FLAPS DESCRIPTION
STEP 1:	ADD	--	Add new records to data base
Update the	DELETE	--	Delete old records from data base
Data base	CHANGE	--	Change records in data base
	COPY	--	Duplicate records in data base
	PROC	--	Initialize the statespace arrays
		--	Terrain mask the fixed threats
(The PROC command		--	Add a threat to the statespace
automatically		--	Delete a threat from the statespace
processes the updated		--	Optimize AGL clearance altitude
data bases through		--	Preprocess staging bases, targets,
target allocation)			and LLTR points
STEP 2:		--	Compute staging base and target
Determine			accessibility
Accessibility			

STEP 3: Compute Routes		-- Calculate ingress and egress route segments
		-- Link path segments to LLTR network
STEP 4: Allocate Weapons		-- Allocate weapons to targets
STEP 5: Allocate Suppression	SELECT	-- Format a route for display and analysis
	ANALIZE	-- Compute threat exposure
	LOCATE	-- Graphically input suppressor location
	SUPPRESS	-- Calculate suppressor effectiveness
	REROUTE	-- Recalculate routes
	RESTORE	-- Remove suppressors from the data base
STEP 6: Output ATO's	SHOW TGUS	-- List the best target allocation data

I.3 OTHER FLAPS FEATURES

FLAPS has many other features which can help the user to effectively solve the force planning problem. The program has been designed to be easy to operate. At the same time, the program is a powerful and flexible force planning tool. Much of this power and flexibility comes from the large FLAPS data bases. FLAPS provides the force planner with the capability to examine all critical elements of the data bases either graphically, in tabular form, or both.

Many parts of the FLAPS data bases can be examined in tabular form using the SHOW command. This command is described in Chapters II and III. The data bases that can be examined with SHOW are described in Chapter IV. The user can examine all critical input and final output data. Input data includes the threat data, prioritized targets, force status data, and airspace coordination data. Final outputs include an ATO-like output. The FLAPS data bases also contain many useful intermediate results that are generated during the force planning process. These intermediate results can be very helpful to the user and can also be examined with the SHOW command.

Besides the tabular data produced by the SHOW command, FLAPS provides the ability to view the data bases and solutions graphically. This feature is discussed in Chapters II and III under the DISPLAY command.

FLAPS is intended to be "user friendly." On-line help is available at any time during program execution. Normally, the user asks for help only when it is needed. In this mode, HELP refreshes the user's memory by explaining a command or a specific suboption. Novice users may invoke a full-time help feature by

issuing the "HELP ON" command. This feature puts the user in a menu-like environment. While this slows down the program, it helps the user learn how to use FLAPS.

I.4 CONVENTIONS USED IN THIS MANUAL

This manual contains many examples that were taken directly from actual FLAPS runs. Generally, FLAPS prompts and outputs are typed in uppercase text. Descriptive text is typed in mixed (upper and lower) case text. User inputs are enclosed in < > brackets. Optional inputs are enclosed in ( ) parenthesis. This makes it clear what text is being issued by FLAPS and what information is being entered by the user.

Most FLAPS commands and suboptions must be typed and entered using the carriage return (RETURN, or <cr>) key. This includes all primary and secondary commands, and most suboptions. The exceptions are certain suboptions for the FIND, LOCATE, and MANUAL commands. The carriage return key is not used for these suboptions. Instead, the thumbwheels and the space bar <sp> are used to position the graphics cursor and input graphic data. In the examples, carriage returns are noted with a <cr> symbol. Carriage returns are shown for all user inputs that require a carriage return.

In the descriptions of the commands, quotes are used to indicate which strings must be input as shown.

In the examples, user inputs are typed in uppercase letters enclosed in brackets < >. However, FLAPS accepts either uppercase or lowercase inputs.

When entering locational coordinates, remember that FLAPS inputs must be in decimal degrees, longitude first and latitude second. Some FLAPS reports do provide output in latitude/longitude, degrees, minutes, and seconds.

Most of the will become very clear when the user actually runs the program. If the user is unclear about how to do something, he or she should try it on the computer. By referring to this manual, using the HELP command, and following the prompts, the user should be able to solve most problems. Good luck.

CHAPTER II

COMMAND OVERVIEW

FLAPS is a command driven program. In order to run the program successfully, the user must be familiar with a number of important commands and their suboptions. Fortunately, the number of commands that the user must learn is small. This chapter is an overview to the FLAPS commands and is intended to help the user get started using the program. Detailed information about the FLAPS commands is contained in Chapter III. The user may find it helpful to go over the example in Chapter V after reading this chapter in order to see how the program responds to the commands described below.

Subsection II.1 describes the VAX/VMS commands that must be issued to run the program. While this information does not refer directly to the FLAPS software, it should help the first-time user run the program.

II.1 GETTING STARTED: RUNNING AND INITIALIZING FLAPS ON A VAX COMPUTER

The FLAPS program runs on Digital Equipment Corporation VAX computers running under the VAX/VMS operating system. The user wishing to run FLAPS should contact the systems manager of the VAX that hosts the program and arrange

access to an account with access to a FLAPS executable and FLAPS data files. Information on how to install the FLAPS software on a VAX computer is contained in Appendix A. Information on how to initialize the FLAPS data bases is in Chapter III and Appendix C. The instructions below assume that the program has already been installed and the data bases have been initialized. Also note that different computer systems may be set up in different ways. If the user has difficulty logging into the VAX or in finding or accessing the FLAPS executable or data files, contact the system manager.

First the user must "log-in" to the VAX. This is normally done by hitting the carriage return (RETURN) key and waiting for the "USERNAME:" prompt to appear on the user's terminal. The user then enters their username and password. If the username and password are accepted, a welcome message appears followed by a dollar sign ($) prompt. Suppose that the user's username is "MINE" and the corresponding password is "WALLOW". The user would login as follows:

```
<cr>
Username: < MINE > <cr>
Password: < WALLOW > <cr>

                .
                .
                .
$
```

If a login is unsuccessful, the user can try to login again.

The user must now link to the directory or subdirectory that contains the desired FLAPS data file. The default directory must contain the data files and the user must have read/write access to these files. Setting the default directory is done using the VAX "SET DEFAULT" command. Suppose the user has logged into the account "MINE" and that the FLAPS data files of interest are in the subdirectory [MINE.DATA]. The user would enter the following command:

S < SET DEFAULT [MINE.DATA] > <cr>

Now, suppose the FLAPS executable is in the subdirectory [MINE.SOURCE] and that the executable is named FLAPS.EXE. Note that the executable does not need to be in the same directory as the data files and it typically is not. The executable is often kept separate from the data files for convenience. To run FLAPS, the user enters the following command:

S < RUN/NODEBUG [MINE.SOURCE]FLAPS.EXE > <cr>

Note that the normal user should not run the program in the debug mode. This is the reason for using the "RUN/NODEBUG" command.

At this point, the FLAPS executable is executed by the VAX. FLAPS writes out the current date and prompts the user as follows:

FLAPS -- DATE = 17-DEC-85 TIME = 12:14:06

Read in previous flaps files "Y"es or "N"o?:

The normal user always answers "Y" to this question. After a YES ("Y") response, FLAPS automatically opens all necessary data files. This assumes that the data bases have been properly installed and initialized. Information on how to install and initialize the data bases is contained in Chapter III and in Appendices A through C. The names of the files that are opened are listed in the command file ZCONTNU.DAT. A typical version of this command file is listed in Appendix C. If the user wishes to open different files with different names, the file names in the ZCONTNU.DAT file must be changed (edited). The VAX file editors will not be discussed in this manual.

FLAPS can now be run. The user will be given a colon (:) prompt and may begin issuing commands. The most often used commands are discussed in the next subsection. All of the commands are discussed in detail in Chapter III.

To summarize, this is how the user would start up a FLAPS session, assuming that the file names are as given above:

```
<cr>

Username: < MINE > <cr>

Password: < WALLOW > <cr>

   (login message from the VAX)

$  < SET DEF [MINE.DATA] > <cr>

$  < RUN/NODEBUG [MINE.SOURCE]FLAPS.EXE > <cr>


 FLAPS  --  DATE = 17-DEC-85      TIME = 12:14:06

 Read in previous flaps files "Y"es or "N"o?:

  < Y > <cr>

 (FLAPS open the data files)

            .

            .

            .


:

 (FLAPS is ready)
```

II.2 COMMAND OVERVIEW

The primary FLAPS commands are listed below:

FLAPS PRIMARY COMMANDS

	Command	Two Character Abbreviation	Purpose
control commands	HELP	HE	Obtain help concerning commands or suboptions.
	READ	RE	Read a command file.
	QUIT	QU	Quit: Stop FLAPS execution and save the current results in the data bases.
databases commands	ADD	AD	Add a record to a data base table.
	DELETE	DE	Delete a record from a data base table.
	CHANGE	CH	Change a record in a data base table.
	SHOW	SH	Show a record from a data base table or show the contents of a data base array.
algorithms and display commands	PROCESS	PR	Process all algorithms through target allocation, using the latest data bases.
	DISPLAY	DI	Display the contents of the data bases on the graphical display.
	FIND	FI	Find an object displayed on the display screen and show information from the data bases that relates to it.
	MANUAL	MA	Manually generate a route to a target.

suppression commands	SELECT	SE	Select a route and store it in the SPED data base table.
	ANALYZE	AN	Analyze a route from the SPED table for threat exposure.
	LOCATE	LO	Locate an EC suppression asset at a specific location or orbit point.
	SUPPRESS	SU	Compute the effects of the EC suppression assets on the statespace.
	ReRoute	RR	Re-calculate the attack aircraft routes using the suppressed statespace.
	ReStore	RS	Restore the statespace and restore the orginal attack aircraft routes.

The user should be able to use FLAPS very effectively using only these seventeen commands. There is another group of commands, called the secondary commands, which are discussed in Chapter III along with the primary commands. The normal user should never have to use these commands and the user need not even read over those sections of Chapter III. However, the user should note that the secondary commands SAVE (SA) and SPAWN (SP) are quite handy.

II.3 A TYPICAL FLAPS SESSION

Most FLAPS sessions involve the user modifying the existing data bases, processing those changes, and then examining the results. For example, a user may run FLAPS and open the data files for a scenario in central Europe. The user may then add some new targets to the target list, delete some of the old targets, and update the status of the aircraft at the various staging bases. The user would then "process" these changes and generate a new plan for the attack aircraft. Next, the user would look at this plan to see how effective it

is against the target set. EC suppression assets could be used to help the attack aircraft penetrate through the FEBA. The user would put these assets in, process their effect, and then look at the new result to see how effective the EC assets were in suppressing the threats. A brief summary of how the user would use the primary FLAPS commands to work through such an example is described below.

First the user would log-into the VAX, set the default directory to the directory or subdirectory containing the files for the central European scenario, and then start the program. The user would open the existing files as described in Subsection II.1, and then issue a series of commands. The commands that the user would use to work through this problem are listed below. Note that the suboptions are not discussed in detail. The user may refer to Chapter V to see examples of the specific suboptions. This list is intended to help the user get a feel for what the primary commands do.

Commands for the Sample Session Described Above

TASK	COMMAND	
Add new targets to the target table.	ADD:	This command will add new records to the target (TG) table. The user will be prompted for the specific data that must be input.
Delete old targets from the target table.	DELETE:	This command will delete old records from the target (TG) table. The user will be prompted for the records that will be deleted.
Update the status of the staging bases.	CHANGE:	This command will change specific items in existing records of the staging base (STGB) table. The user will be prompted for the table,records, items, and new data.

Process these changes and generate a new attack aircraft plan.	PROC:	This command will update the appropriate arrays and run the necessary algorithms to generate the new attack aircraft plan.
Display the new scenario, including the new targets.	DISPLAY:	This command will display the new scenario. The user will be prompted for the options that he or she may display. In this example, the "M" (MISSION) option.
Examine the results.	SHOW:	This command will allow the user to look at the attack aircraft plan and effectiveness data. The user will be prompted for the tables and arrays that he or she may show. In this example, the TGUS array is the relevant array.
Put the attack aircraft routes into the SPED table so that they can be displayed.	SELECT:	This command will format the routes and add them into the SPED file. The user will be prompted for which specific routes he or she wishes to select. In this example, the user would select "ALL" of the routes.
Display the attack aircraft routes.	DISPLAY:	This command allows the user to add things to the existing display. In this example, the user would select the "R" (ROUTE) option.
Put EC aircraft into the scenario.	LOCATE:	This command allows the user to put EC aircraft at specific locations within the scenario. The user graphically inputs the position and indicates the type of the EC aircraft.
Display the EC aircraft locations.	DISPLAY:	Again the user would add the suppressor locations to the existing display. The user would use the "SU" (SUPPRESSOR) option.
Compute the effects of the EC aircraft on the statespace.	SUPPRESS:	This command automatically updates the statespace to account for the effects of defense suppression.

Display the effects of the EC aircraft on the statespace.	DISPLAY: Again, this command will update the current display. In this case, the user would select the "D" (DANGER CONTOUR) option.
Recompute the attack aircraft plan, using the suppressed statespace.	REROUTE: This command automatically recomputes the attack aircraft plan.
Show the new plan, select and display the new routes.	SHOW, SELECT, and DISPLAY as above.

Again, the user is referred to Chapter V for a more complete example. The primary commands are discussed in more detail in the following subsections.

The format descriptions below use the notation conventions described in Chapter I. Recall that user input options are enclosed in < > brackets. These are inputs that the user must enter. Some options are not required but may be input if the user desires. These optional items are enclosed in ( ) parentheses. All commands may be input in lowercase, even though the examples are typed in uppercase.

II.4 THE CONTROL COMMANDS

The control commands are HELP (HE), READ (RE), and QUIT (QU). These commands provide high level control over the program. The commands and their suboptions are described briefly below. The exact formats for the commands and their suboptions are described in detail in Chapter III.

II.4.1 HELP (HE): The HELP Command

FORMAT: "HE" <cr> or "HE" <"ON" or "OF"> <cr>

EXAMPLES: HELP
HE PR
HE ON
HE OF

The HELP command provides help to the interactive user. HELP does two things, depending on how it is used. If the user enters "HELP"<cr>, "HE"<cr>, or "?"<cr>, FLAPS will come back with a list of commands about which the user can get help. These suboptions are:

SUBOPTION	TWO CHARACTER ABBREVIATION	DESCRIPTION
ABORT	(AB)	Exit from the help command
GENERAL HELP	(GE)	General help about FLAPS
PRIMARY COMMANDS	(PR)	A list and description of the primary commands
SECONDARY COMMANDS	(SE)	A list and description of the secondary commands
CURRENT PROCESSING STATUS	(ST)	A description of the status of the data bases.

The user exits from HELP by entering the "AB" (ABORT) suboption.

HELP can also be used to control the way FLAPS prompts users for information. Whenever the user enters a command that requires additional inputs, FLAPS prompts for the input. Normally these prompts are very brief. If a beginning user wants more detailed prompts then he or she may turn on the "help always" feature. This is done by typing: "HE ON" <cr> or "HELP ON" <cr>. The user will not see the normal HELP menu described above. However, the user will get a detailed prompt every time he or she inputs a command that requires additional inputs. The user types "HE OF" (HELP OFF) to turn off the "help always" feature.

II.4.2 READ (RE): The READ Command

FORMAT: "RE" <command file name> <"Y" or "N"> <cr>

EXAMPLE: RE EDEMO.DAT Y

The READ command is used to read FLAPS command files and execute them. A command file is a VAX/VMS file which contains a list of FLAPS commands. Command files are typically used to input large amounts of data into the program (see Appendix C, for example). If the user enters "READ" <cr> or "RE" <cr>, FLAPS will prompt the user for the command file name. The user responds to this by simply typing in the name of the command file followed by a <cr>. FLAPS will then ask the user if he wants to watch the file being read in (ECHO). The user responds with either "Y" (yes) or "N" (no).

II.4.3 QUIT (QU): The QUIT Command

FORMAT: "QU" <cr>

EXAMPLE" QU

The QUIT command is used to exit the program. It is the only way to exit the program, other than pulling the plug on the computer.

II.5 THE DATA BASE COMMANDS

The data base commands ADD, DELETE, and CHANGE manipulate the data base tables in the FLAPS data bases. The SHOW command is used to show the contents of both data base tables and arrays.

II.5.1 ADD (AD): The ADD Command

FORMAT: "AD" <table name> <first item, second item, ect.> <cr>

EXAMPLE: AD THRT TH01 SA-11 1[illegible].00 55.00 20 1.0

The ADD command is used to add records to a data base table. The user is prompted for the table (TABLE NAME) that he or she wishes to add to. Then the user is prompted for data to fill the new record.

II.5.2 DELETE (DE): The DELETE Command

FORMAT: "DE" <table name> <id, or first, or only record number>
(<last record number>) <cr>

EXAMPLE: DE THRT TH01

The DELETE command deletes records from a data base table. The user is prompted for the table (TABLE NAME) that he or she wishes to delete from. Then the user is prompted for the record, or range of records, that he or she wishes to delete.

II.5.3 CHANGE (CH): The CHANGE Command

```
FORMAT: "CH" <table name> <record id or record number> <item name>
             <new data value or values> (<next item name>
             <new data value or values>, ect.)
             "/" <cr>
```

EXAMPLE: CH THRT TH01 ITYP SA-8 /

The CHANGE command changes the contents of records in a data base table. The user is prompted for the name of the table that he or she wishes to change, and the record id or record number (either may be used, whichever is more convenient for the user). Then the name of the item that the user wishes to change, and the new data value for the item. If the item is a vector, then the user may enter values for all elements of the vector. The user may then continue entering item names and new values until he or she wishes to stop. CHANGE is exited by typing a "/" <cr>.

II.5.4 SHOW (SH): The SHOW Command

FORMAT: (For Tables)

```
"SH" <table name> (<item name> <item name> ect. "/")
    <record id or first record number>
   (<last record number>) <cr>
```

(For Arrays)

```
"SH" <array name> <additional data as necessary> <cr>
```

EXAMPLES: (For Tables)

```
SHOW THRT TH01

SHOW THRT ID ITYP / TH01

SHOW THRT ID ITYP / 2 10
```

(For Arrays)

```
SHOW TGUS

SHOW ARPE CASLAV
```

The SHOW command is used to show the content of data base tables and arrays. The user is prompted for the name of the thing he or she wishes to show. This is either a data base table or array name.

If the user is showing the contents of a data base table, the name (or names) of the item (or items) that he or she wishes to show, followed by a slash to complete the list may be entered. Then the user must enter in the id or record number of the record he or she wishes to show. If record numbers are used, the user may show a range of records by entering the first and last record number. Alternatively, if the user wants to show the entire contents of the table, he or she may skip the list of items and only enter the record id or range of record numbers.

If the user is showing the contents of a data base array, then the prompts are issued on a case by case basis. Many arrays require no additional data at all.

II.6 THE ALGORITHM AND DISPLAY COMMANDS

These are the PROCESS (PR), DISPLAY (DI), FIND (FI), and MANUAL (MA) commands. FIND and MAKE should only be used when working on a Tektronix 4115 or 4125 terminal.

II.6.1 PROCESS (PR): The PROCESS Command

FORMAT: "PR" <attack aircraft penetration altitude level> <cr>

EXAMPLE: PR 1

The process command processes the data bases through initial (pre-suppression) attack aircraft weapons allocation. The user must input the altitude level that he or she wishes to use. The altitude level refers to the levels contained in the ALGP table. Appropriate values for the altitude level are 1, 2, 3, 4, or 5. Other suboptions may be input, however these should not be used by the normal user.

II.6.2 DISPLAY (DI): The DISPLAY Command

FORMAT: (For Graphic Displays)

"DI" <display option> (<display option> <display option> ect.)
"/" (<suboptions as necessary>) <cr>

(For Scaling the Display)

"DI SC" <"SC" or "ST" or min-long, max-long, min-lat, max-lat> <cr>

EXAMPLE: (For Graphic Displays)

DI M /

DI M L D / TH3D 0.005 0.05 0.1 0.25 / 6 2

(For Scaling the Display)

DI SC ST

DI SC 13.5 15.0 58.0 59.0

The DISPLAY command is used for creating graphic displays and for scaling the display area for future displays. All display options may be seen in a very convenient form by typing help after being prompted for options.

The user is first asked to enter his or her desired options. To create a display, the user lists the cotions to be displayed, followed by a slash to end the list. Suboptions may be necessary. If this is the case, the user is prompted for these on a case by case basis.

If the user wishes to rescale the display, an "SC" (for SCALE) is entered. Then the user may input an "SC" (to rescale to the scenario), an "ST" (to rescale to the statespace), or a longitude and latitude window. The display is updated automatically.

II.6.3 FIND (FI): The FIND Command

FORMAT: "FI" <type of thing the user wishes to find> <cr>
<move cursor using thumbwheels> <sp>

EXAMPLE: FI TG <move cursor> <sp>

The FIND command is used to identify objects on the color graphics display. The user is prompted as to what the options are. At this time, it is possible to find Targets, Staging Bases, Threats, LLTR points, and general long/lat locations. Once the user is in graphics mode, many inputs can be made using single keystrokes. It is not necessary to enter a carriage return.

II.6.4 MANUAL (MA): The MANUAL Command

FORMAT: "MA" <cr> <additional inputs as required>

EXAMPLE: MA

The MANUAL command is used to manually create attack aircraft routes. The user is prompted as to what the options are. At this time, it is possible to create ingress and egress routes using a variety of options. Once the user is in graphics mode, many inputs can be made using single keystrokes. It is not necessary to enter a carriage return.

II.7 THE SUPPRESSION COMMANDS

The suppression commands are used to determine where EC threat suppression is needed, to locate (position) it in the scenario, and to compute its effects.

II.7.1 SELECT (SE): The SELECT Command

FORMAT: "SE" "ALL" <cr>

or

"SE" "/" <target ID> <staging base ID> <cr>

EXAMPLES: SE ALL

SE / CASLAV RAMSTEIN

The SELECT command causes one or more routes to be written to the SPED table. From the SPED table, the routes may be displayed or analyzed. If the user wants all routes in the current attack aircraft allocation to be written to the SPED table, he or she should enter "ALL". If the user only wants one particular route written to the SPED table, he or she should enter a "/", then the target ID (or index), and the staging base ID (or index). The individual route is taken from the "ROUT" array. A route must exist in the ROUT array before it can be selected.

II.7.2 ANALYZE (AN): The ANALYZE Command

FORMAT: "AN" <SPED table record ID, or record number> <cr>

EXAMPLES: AN BITB.CASL.01

AN 2

The ANALYZE command is used to analyze a route from the SPED table for threat exposure. The user inputs either the ID or the record number of the SPED table record of interest. A detailed report on the survivability on that route and threat exposure is generated.

II.7.3 LOCATE (LO): The LOCATE Command

FORMAT: "LO" <cr> <move the cursor to the desired position, using thumbwheels> <sp> <suppressor type> <cr> <suppressor id> <cr>

EXAMPLE: LO·<move cursor> EF-111 EF-111.1

The LOCATE command is used to position EC threat suppression assets in the scenario. The user is prompted from the terminal to make graphic inputs.. LOCATE creates records in the SUPP (Suppressor Position) table.

II.7.4 SUPPRESS (SU): The SUPPRESS Command

FORMAT: "SU" <"YES" or "NO"> <cr>

EXAMPLE: SU YES

The SUPPRESS command is used to calculate the effects of the EC suppression assets on the statespace. FLAPS calculates how many threats each suppressor will effect, and reports this to the user. The user is then asked whether or not he or she wishes to continue. If the user answers "YES", then FLAPS calculates the effects of the suppressors and degrades the statespace accordingly. If the user answers "NO", FLAPS does not continue and the colon (:) prompt is displayed for the next command. If the user feels that the suppressors will not have the desired effect, or that they the have been misplaced (i.e., LOCATEd incorrectly), then the user may move them someplace else. The suppression effectiveness is based on the SUPM (Suppression Model) and SUPP (Suppression Position) tables.

II.7.5 REROUTE (RR): The REROUTE Command

FORMAT: "RR" <cr>

EXAMPLE: RR

The REROUTE command recalculates the attack aircraft plan after the EC suppression assets have been applied to the statespace. No additional user inputs are necessary. The user should only use the REROUTE command after inputting suppressor positions (LOCATE) and suppressing the statespace (SUPPRESS).

II.7.6 RESTORE (RS): The RESTORE Command

FORMAT: "RS" <cr>

EXAMPLE: RS

The RESTORE command restores the statespace to its pre-suppression value and recalculates the attack aircraft plan. This effectively restores the data bases to the way they were before EC suppression was applied. No additional user inputs are necessary. The user may then make modifications to the data bases and generate a new plan.

CHAPTER III

COMMANDS

The available FLAPS commands are described in this section. They are subdivided into two categories: primary and secondary commands. Primary commands are those which are most likely to be used by planners; secondary commands are those with which most planners are not concerned -- they are normally used by program developers. These two types of commands are described in detail in Subsections III.2 and III.3, respectively.

The beginning user reading this manual for the first time may skip this chapter entirely. After reading Chapters I and II the beginning user should go directly to Chapter V and study the example. This chapter is meant to be a reference to answer specific questions about commands and suboptions. Similarly, Chapter IV is meant to be a reference for the FLAPS data bases.

Note that the commands in this chapter are often referred to as two character keywords. The FLAPS user interface has been designed so that all commands and many suboptions can be entered using only two characters. Usually the minimum input is the first two characters of the "command word". For

example, instead of typing "PROCESS", the user could type "PR". There are some exceptions to this rule. For example, the "READ", "REROUTE", and "RESTORE" commands begin with "RE". In order to make the two-character commands unique, the "REROUTE" and "RESTORE" commands are executed by typing "RR" and "RS" respectively. The other exception is "DEBUG" which is executed by typing "DB". The two character rule only applies to FLAPS commands and subcommands. Other inputs must be typed out in full. This includes data file names and data base record item names.

This Chapter is organized into three parts. Subsection III.1 describes the general help feature. Subsection III.2 describes the primary commands. This material is very similar to that covered in Chapter II, but is slightly more detailed. Subsection III.3 describes the secondary commands. The normal user should never have to use these commands. However, the SAVE (SA) and SPAWN (SP) commands are very handy.

III.1 GENERAL HELP

FLAPS provides extensive on-line help to the interactive user. The on-line help feature is described in detail in Section III.1.1. The following excerpt, which gives general information about entering commands, was obtained from the program. Additional help excerpts appear in this section of the manual as capitalized text.

FLAPS GENERAL HELP

THE USER MAY OBTAIN HELP EVERY TIME HE TYPES A <CR>
BY TYPING THE COMMAND "HE ON"; OR HE MAY TURN THIS
FEATURE OFF BY TYPING "HE OF". CURRENTLY, THE SET-
TING IS HELP ON.

FLAPS COMMANDS MAY BE ISSUED BY TYPING SEVERAL ITEMS

```
ON THE SAME LINE FOLLOWED BY A <CR> (TYPE-AHEAD MODE),
OR BY TYPING EACH ITEM FOLLOWED BY <CR>, AND LETTING
FLAPS PROMPT FOR THE NEXT ITEM.  FLAPS COMMANDS MAY BE
TYPED IN UPPER OR LOWER CASE.  MOST FLAPS KEYWORDS MAY
EITHER BE ABBREVIATED TO 2 LETTERS OR TYPED IN FULL--
E.G."SHOW" OR "SH".

TO ABORT ANY FLAPS COMMAND, TYPE "AB" OR "ABORT".


TO EXIT FROM THE HELP COMMAND,        TYPE "AB"
TO GET GENERAL HELP                   TYPE "GE"
TO GET A LIST OF PRIMARY COMMANDS     TYPE "PR"
TO GET A LIST OF SECONDARY COMMANDS   TYPE "SE"
TO SEE THE CURRENT PROCESSING STATUS  TYPE "ST"
```

If the user asks for general help (GE), the information printed above will repeat. If the user asks for a list of the primary commands (PR), the following message will be written to the terminal:

```
FLAPS PRIMARY COMMANDS

 CONTROL COMMANDS:
    HE      OBTAIN HELP
    RE      READ COMMANDS FROM A FILE
    QU      QUIT FLAPS EXECUTION
 DATA BASE COMMANDS:
    AD      ADD A RECORD TO THE DATA BASE
    DE      DELETE A RECORD FROM THE DATA BASE
    CH      CHANGE A RECORD IN THE DATA BASE
    SH      SHOW CONTENTS OR STRUCTURE OF DATA BASE
 ALGORITHMS AND DISPLAY:
    PR      PROCESS ALL ALGORITHMS
    DI      PRODUCE A GRAPHICAL DISPLAY
    FI      FIND OBJECT IN GRAPHICAL DISPLAY
    MA      MANUALLY GENERATE A ROUTE
 SUPPRESSION COMMANDS:
    SE      SELECT ROUTE(S)
    AN      ANALYZE ROUTE
    LO      LOCATE SUPPRESSOR
    SU      APPLY SUPPRESSION
    PR      RE-CALCULATE ROUTE WITH SUPPRESSION
    RS      RESTORE ENVIRONMENT W/O SUPPRESSORS
```

These commands are discussed in detail in Subsection III.2.

If the user asks for a list of the secondary commands (SE), the following message will be written out to the terminal:

```
FLAPS SECONDARY COMMANDS

    OP      OPEN AN ARRAY OR TABLE
    CO      COPY RECORD WITHIN A TABLE
    DB      SET DEBUG SWITCH
    DR      DRAW A ROZ OR WFZ POLYGON
    IN      INITIALIZE DATA BASE
    SA      SAVE ALL FILES AND CONTINUE EXECUTION
    SP      SPAWN A BATCH JOB
    PA      SHOW CURRENT VALUES OF PARAMETERS
  THE FOLLOWING ARE THE INDIVIDUAL ALGORITHMS:
    GE      CALCULATE GEOMETRY
    ST      GENERATE STATESPACE
    NO      CALCULATE NODES
    AC      CALCULATE ACCESSIBILITY
    AR      GENERATE OPTIMAL ARCS BETWEEN NODES
    RO      ROUTES BETWEEN STAGING BASES,TARGETS
    AL      ALLOCATE TIME WINDOWS TO ROUTES
```

These commands are discussed in detail in Subsection III.3.

If the user asks to see the current processing status (ST), a message like the following will be written to the terminal.

```
  A "PR" COMMAND WILL EXECUTE ALL ALGORITHMS WHOSE STATUS IS BAD

    ALGORITHM     STATUS    ESTIMATED TIME

    STATESPACE    GOOD         TBD
    NODES         GOOD         TBD
    ACCESS        GOOD         TBD
    ARCS          GOOD         TBD
    ROUTES        GOOD         TBD
    ALLOCATE      GOOD         TBD
```

The user exits from the help menu by typing "AB" (ABORT).

III.2 PRIMARY COMMANDS

The FLAPS primary commands are used frequently by the majority of FLAPS users. These commands are discussed briefly in Chapter II and in detail below. The example in Chapter V illustrates how the primary commands are used.

Remember that brackets < > enclose a set of input options of which the user must choose one. Parentheses ( ) enclose optional command parameters. Optional parameters are not required to execute the command initially but are needed to execute specific command functions. Double quote marks " " enclose alpha-numerics which the user types on the terminal to execute a command or suboption.

The FLAPS primary commands are listed below.

FLAPS PRIMARY COMMANDS

CONTROL COMMANDS:	
HE	OBTAIN HELP
RE	READ COMMANDS FROM A FILE
QU	QUIT FLAPS EXECUTION
DATA BASE COMMANDS:	
AD	ADD A RECORD TO THE DATA BASE
DE	DELETE A RECORD FROM THE DATA BASE
CH	CHANGE A RECORD IN THE DATA BASE
SH	SHOW CONTENTS OR STRUCTURE OF DATA BASE
ALGORITHMS AND DISPLAY:	
PR	PROCESS ALL ALGORITHMS
DI	PRODUCE A GRAPHICAL DISPLAY
FI	FIND AN OBJECT GRAPHICALLY
MA	MANUALLY GENERATE A ROUTE
SUPPRESSION COMMANDS:	
SE	SELECT ROUTE
AN	ANALYZE ROUTE
LO	LOCATE SUPPRESSOR
SU	APPLY SUPPRESSION
RR	RE-CALCULATE ROUTE WITH SUPPRESSION
RS	RESTORE ENVIRONMENT W/O SUPPRESSORS

III.2.1 HELP Command

FORMAT: "HE" or "?" ("AB" or "GE" or "PR" or "SE" or "ST") <cr>

or

"HE" ("ON" or "OF") <cr>

EXAMPLES:

HE	(Get general help and the help menu)
?	(Get general help and the help menu)
HE ON	(Turn on the permanant help feature)
HE ST	(Get general help and the current status)

The HELP command provides help to the interactive user of FLAPS. The user may type "HE" <cr>, "HELP" <cr>, or "?" <cr> to display the general help message. This message is shown in Section III.1 above.

The user must then specify if he or she wishes further help. An "AB" (ABORT) response returns to the FLAPS command level; "GE" (GENERAL) repeats the general help message; "PR" (PRIMARY) and "SE" (SECONDARY) give a list of the primary and secondary commands, respectively; and "ST" (STATUS) provides the processing status as explained under the PROCESS command (Section III.2.8).

The user may also type ahead to get a list of the primary ("HE PR") or secondary ("HE SE") commands or see the current processing status ("HE ST").

The HELP command is also used to set or clear the global help variable. The user sets the global help variable to ON by typing "HE ON" <cr> and clears it (turns it OFF) by typing "HE OF" <cr>. When this variable is set to ON, the user is able to receive help messages whenever a reminder of the command syntax is needed. A help message is given after every carriage return. The help message will give a description of the user's options and their meanings. If

the global help variable is off, the user still receives some help in the form of a terse one-line prompt. If the user is in the middle of typing a command, the global help variable is off, and the user would like to display a full description of the options, it may be obtained by typing "HE" <cr>, "HELP" <cr>, or "?" <cr>.

III.2.2 READ Command

FORMAT: "RE" <command file name> <"Y" or "N"> <cr>

EXAMPLE: RE ZDEMO Y (Read the command file ZDEMO.DAT and echo the command lines back to the terminal)

The READ command is used to read commands from a file, rather than typing them in interactively. After typing "RE" (READ), the user will be prompted to enter the name of the command file. The prompt looks like this:

```
CRREAD-FILE:

 ENTER NAME OF COMMAND FILE TO BE READ
FILENAME:
```

The user then types the name of the command file. Next, the user must specify whether the commands read from the file are to be echoed on the terminal. This requires a yes or no answer. The prompt looks like this:

```
CRREAD-ECHO:

 ENTER "YES" IF COMMANDS ARE TO BE ECHOED ON YOUR
  TERMINAL;  OTHERWISE, ENTER "NO"
ECHO--"YES" or "NO":
```

Command files are normally used for data base initialization. These files are created using the VAX text editor. A naming convention has been established for FLAPS command files. Command files normally begin with a "Z" and end with the ".DAT" suffix. The user may give a command file an name, but the "Z" and "DAT" convention helps to avoid confusion between the command files and the other FLAPS data base files. For example, "ZDEMO.DAT" is the standard

scenario initialization file. The ".DAT" suffix is a FLAPS default, therefore it is unnecessary to enter the filetype ".DAT".

Command files are usually the easiest way to enter large volumes of data into the program. The typical command file, like ZDEMO, is a large collection of ADD commands. The ADD commands for the threats, targets, staging bases, and LLTR nodes are all listed in the "ZDEMO.DAT" file. Changes to the data base may also be made using command files and the DELE, ADD, and CHAN commands. A number of important command files are contained in the appendices of this manual.

III.2.3 QUIT Command

FORMAT: "QU" <cr>

EXAMPLE: QU (End the current FLAPS session)

The QUIT command is used to terminate the execution of FLAPS. All of the data base files are stored on disk when QUIT is executed. The next time a FLAPS session is begun using these files (i.e., from the same default directory or subdirectory), the user where he or she left off when the QUIT command was issued.

III.2.4 ADD Command

FORMAT: "AD" <table name> <table specific items> <cr>

EXAMPLE: AD THRT TH01 SA-11 13.0 55.0 20 1.0 (Add a record to the THRT table.)

The ADD command is used to add a record to the data base. First the user or command file must specify the table name. The prompt has the following form:

```
CRADD -TABL:

 ENTER NAME OF TABLE TO BE MODIFIED:

   NAME          TITLE

   ALGP     ALGORITHM PARAMS
   CURR     CURRENT STATUS
   LLTR     LLTR NODE PARAMETERS
   ROZ      RESTRICTED OPERATING ZONES
   STCH     STOCHASTIC REGIONS
   STGB     STAGING BASE PARAMS
   SUPM     SUPPRESSION MODELS
   SUPP     SUPPRESSOR TYPE
   SWCH     VARIOUS SWITCHES
   TG       TARGET PARAMS
   THRT     THREAT LOCATIONS
   TMDL     THREAT MODELS
   VEHP     VEHICLE PARAMETERS
   WFZ      WEAPON FREE ZONES

 TABLE NAME:
```

The user is then prompted to enter the information that goes into the new record. The information will go into scalar and vector items. A scalar item consists of a single entry, like the record ID. A vector item contains multiple entries. For each scalar item (size = 1) in the table, the value of the item in the new record must be specified:

```
CRADD -VALU:

 ENTER VALUE FOR ITYP IN TABLE THRT
    FORMAT     =CH08
    DESCRIPTION=THREAT TYPE
  OR ENTER "/" TO FILL REST OF RECORD WITH 0
ITYP(    1)  FMT=CH08,  SIZE=   1                      :
```

For each vector item (size > 1) in the table, the value for each element of the item in the new record must be specified:

```
CRADD -VALU:

 ENTER VALUE FOR XTH (    2) IN TABLE THRT
    FORMAT     =REAL,  SIZE=   3
    DESCRIPTION=GEOD LON,LAT,ELE OF DEF
  OR ENTER "/" TO FILL REST OF XTH  WITH 0
XTH (    2)  FMT=REAL,  SIZE=   3                      :
```

The effect of a slash ("/") is different if entered in response to a scalar or a vector item. If entered in response to a scalar item, a slash causes the rest of the record to be filled with zeroes, and the record to be entered into the data base. If entered in response to a vector item, a slash causes the remaining elements of the item to be filled with zeroes and proceeds to the next item in the table.

III.2.5 DELETE Command

```
FORMAT:   "DE" <table name> <record ID or record number or
                             first record number>
                            (last record number) <cr>

EXAMPLES: DE THRT TH01          (Delete the THRT record ID TH01)
          DE THRT 2             (Delete the THRT record no. 2)
          DE THRT 10 15         (Delete the THRT records
                                 numbers 10 through 15)
```

The DELETE command is used to delete one or more records from the data base. First the user or command file must specify the table. The prompt looks like this:

```
CRDELE-TABL:

 ENTER NAME OF TABLE TO BE MODIFIED:

   NAME          TITLE

   ALGP      ALGORITHM PARAMS
   CURR      CURRENT STATUS
   LLTR      LLTR NODE PARAMETERS
   ROZ       RESTRICTED OPERATING ZONES
   STCH      STOCHASTIC REGIONS
   STGB      STAGING BASE PARAMS
   SUPM      SUPPRESSION MODELS
   SUPP      SUPPRESSOR TYPE
   SWCH      VARIOUS SWITCHES
   TG        TARGET PARAMS
   THRT      THREAT LOCATIONS
   TMDL      THREAT MODELS
   VEHP      VEHICLE PARAMETERS
   WFZ       WEAPON FREE ZONES

 TABLE NAME:
```

Then the record or range of records to be deleted must be specified:

```
CRDELE-RCID:

 ENTER ID OR RECORD NUMBER FOR A SINGLE RECORD IN THRT
  OR ENTER STARTING AND ENDING RECORD NUMBERS SEP-
  ARATED BY SPACE OR COMMA FOR A RANGE OF RECORDS
REC1 "to" REC2 or IDWORD:
```

III.2.6 CHANGE Command

```
FORMAT:  "CH" <table name> <record ID or record number>
               <item name>  <new data value or values>
              (<next item name> <new data value or values>, etc.)
               "/" <cr>

EXAMPLE:  CH THRT 5 XTH SU 25.0 /    (Change THRT record 5 so that
                                      the threat antenna is located
                                      25.0 meters above the
                                      terrain.)
```

The CHANGE command is used to change a record to the data base. First the user or command file must specify the table name. The prompt looks like this:

```
CRCHAN-TABL:

 ENTER NAME OF TABLE TO BE MODIFIED:

   NAME          TITLE

   ALGP      ALGORITHM PARAMS
   CURR      CURRENT STATUS
   LLTR      LLTR NODE PARAMETERS
   ROZ       RESTRICTED OPERATING ZONES
   STCH      STOCHASTIC REGIONS
   STGB      STAGING BASE PARAMS
   SUPM      SUPPRESSION MODELS
   SUPP      SUPPRESSOR TYPE
   SWCH      VARIOUS SWITCHES
   TG        TARGET PARAMS
   THRT      THREAT LOCATIONS
   TMDL      THREAT MODELS
   VEHP      VEHICLE PARAMETERS
   WFZ       WEAPON FREE ZONES

 TABLE NAME:
```

Next the record to be changed must be specified:

```
CRCHAN-RCID:

 ENTER EITHER ID OR RECORD NUMBER FOR RECORD IN THRT
RECORD NUMBER or NAME:
```

Then the name of the next item to be changed must be specified:

```
CRCHAN-ITEM:

 ENTER NEXT ITEM OR "/" IF ALL CHANGES HAVE BEEN MADE

LUN  NAME  LREC   MXRC  NREC  NITM  IPTR    TITLE

85   THRT     9   200    53     6   251  THREAT LOCATIONS

        NAME     TYPE   SIZE   LOC     TITLE

        ID       CH04     1     1    THREAT ID
        ITYP     CH08     1     2    THREAT TYPE
        XTH      REAL     3     4    GEOD LON,LAT,ELE OF DEF
        PEX      REAL     1     7    PROBABILTY THREAT EXISTS
 ITEM NAME or "/":
```

Depending on which item was specified, the information will go into scalar or a vector item. A scalar item consists of a single entry, like the record ID. A vector item contains multiple entries. If the item is a scalar (size=1) then its new value must be specified:

```
CRCHAN-VALU:

 ENTER VALUE FOR ITYP IN TABLE THRT
    FORMAT      =CH08
    DESCRIPTION=THREAT TYPE
  CURRENT VALUE=BIGGIE
ITYP(    1)   FMT=CH08,  SIZE=   1                  :
```

If the item is a vector (size > 1), then the values for each element must be specified, starting with the first element. After entering values for the first element (or the first few elements), the user may type a "/" so that the remaining elements in the vector will be left unchanged. Alternatively, by typing "SU", the subscript for the first element to be changed may be selected:

```
CRCHAN-VALU:

 ENTER VALUE FOR XTH (    1) IN TABLE THRT
    FORMAT      =REAL,  SIZE=   3
    DESCRIPTION=GEOD LON,LAT,ELE OF DEF
  CURRENT VALUE= 1.3000E+01
  OR ENTER "/"  TO LEAVE REST OF XTH UNCHANGED
  OR        SU   TO RESET SUBSCRIPT
XTH (    1)   FMT=REAL,  SIZE=   3                    :
```

If "SU" was selected, then the subscript must be specified:

```
CRCHAN-SUBS:

 ENTER NEW SUBSCRIPT--CURRENTLY=    1, MAX=   3
STARTING POSITION IN ARRAY:
```

Once all changes have been entered, the user must type "/" to write the modified record to the data base.

III.2.7 SHOW Command

FORMAT: (For Tables)

```
"SH" <table name> (<item name> <item name> etc. "/")
    <record id or record number or first record number>
   (<last record number>) <cr>
```

(For Arrays)

```
"SH" <array name> <additional data as necesary> <cr>
```

EXAMPLES: (For Tables)

```
SH TG LEGNICA
SH LLTR 2 4
SH ALGP DELE DELN / 2
```

(For Arrays)

```
SH NPOS
SH ARCS LEIPZIG S123
```

The SHOW command shows selected portions of the data base on the user's terminal. The user must first specify which table or array is desired.

```
CRSHOW-NAME:

 ENTER "PLAN" TO SHOW FLIGHT PLAN
  OR ENTER 4-CHARACTER TABLENAME,
  OR TA TO SHOW STRUCTURES OF TABLES:

   NAME          TITLE

   ALGP     ALGORITHM PARAMS
   CURR     CURRENT STATUS
   LLTR     LLTR NODE PARAMETERS
   ROZ      RESTRICTED OPERATING ZONES
   STCH     STOCHASTIC REGIONS
   STGB     STAGING BASE PARAMS
   SUPM     SUPPRESSION MODELS
   SUPP     SUPPRESSOR TYPE
   SWCH     VARIOUS SWITCHES
   TG       TARGET PARAMS
   THRT     THREAT LOCATIONS
```

```
     TMDL      THREAT MODELS
     VEHP      VEHICLE PARAMETERS
     WFZ       WEAPON FREE ZONES

    TABLE NAME:

  OR ENTER 4-CHARACTER ARRAYNAME,
  OR AR TO SHOW STRUCTURE OF ARRAYS:

     NAME             TITLE

     ARCS      ARC WAYPOINT ARRAY
     ARPE      TARG INGRESS/EGRESS PERF
     ITGC      TARG ACCESSIBLE TO STGB
     ITRC      TREX ACCESSIBLE TO TREN
     NBOX      LIST OF TG BOX CORNERS
     NLIS      LIST OF NODES
     NPOS      NODE POSITIONS
     ROUT      ROUT NODES DIST AND PERF
     SXPE      STGB TO LLTR EXIT PERF
     TGUS      TARGET STATUS ARRAY
     TRPE      LLTR TREE PERFORMANCE

 ARRAYNAME or TABLENAME:
```

In the case of a table, the user may either specify individual items to be shown or request that all items in one or more records be shown:

```
   CRSHOW-OPTN:

   TO SHOW 1 OR MORE ENTIRE RECORDS:

    ENTER ID OR RECORD NUMBER FOR A SINGLE RECORD IN THRT
     OR ENTER STARTING AND ENDING RECORD NUMBERS SEP-
     ARATED BY SPACE OR COMMA FOR A RANGE OF RECORDS

   OR TO SHOW SELECTED ITEMS, TYPE 1ST ITEMNAME:

 LUN  NAME  LREC   MXRC  NREC  NITM  IPTR    TITLE

 85   THRT     9   200    52     6   251  THREAT LOCATIONS

         NAME    TYPE   SIZE   LOC     TITLE

         ID      CH04     1     1    THREAT ID
         ITYP    CH08     1     2    THREAT TYPE
         XTH     REAL     3     4    GEOD LON,LAT,ELE OF DEF
         PEX     REAL     1     7    PROBABILTY THREAT EXISTS
```

```
        IDC      INT       1      8    RECORD CREATION DATE
        IDM      INT       1      9    RECORD MODIFICATION DATE
  "RECO" or ITEMNAME:
```

If individual items are desired, then their names must be entered, terminated by a slash and then the record or range of records must be specified:

```
  CRSHOW-ITEM:

   ENTER NEXT ITEM OR "/" IF ALL ITEMS HAVE BEEN SELECTED

 LUN  NAME  LREC   MXRC  NREC  NITM  IPTR    TITLE

 85   THRT     9   200    52     6   251  THREAT LOCATIONS

        NAME     TYPE   SIZE   LOC     TITLE

        ID       CH04    1      1    THREAT ID
        ITYP     CH08    1      2    THREAT TYPE
        XTH      REAL    3      4    GEOD LON,LAT,ELE OF DEF
        PEX      REAL    1      7    PROBABILTY THREAT EXISTS
        IDC      INT     1      8    RECORD CREATION DATE
        IDM      INT     1      9    RECORD MODIFICATION DATE
  ITEMNAME or "/":

  CRSHOW-RCID:

   ENTER ID OR RECORD NUMBER FOR A SINGLE RECORD IN THRT
    OR ENTER STARTING AND ENDING RECORD NUMBERS SEP-
    ARATED BY SPACE OR COMMA FOR A RANGE OF RECORDS
  REC1 "to" REC2 or IDWORD:
```

If an array is chosen, then more information may have to be specified. For the ARCS array, the target and LLTR must be specified:

```
  PROMID-RCID:

   ENTER ID OR INDEX OF TGT
     OR "/" TO ABORT COMMAND--HEY WHY NOT JUST "AB"?
  TGT  ID, INDEX, or /                :
```

```
PROMID-RCID:

 ENTER ID OR INDEX OF LLTR
   OR "/" TO ABORT COMMAND--HEY WHY NOT JUST "AB"?
LLTR ID, INDEX, or /                :
```

For the ARPE, ITGC, ROUT and SXPE arrays, the target(s) have to be specified:

```
PROMID-RCID:

 ENTER ID OR INDEX OF TGT
   OR "/" TO ABORT COMMAND--HEY WHY NOT JUST "AB"?
   OR "ALL" FOR ALL TGT
TGT   ID, INDEX, ALL, OR /          :
```

For the ITRC and TRPE arrays, the LLTR(s) have to be specified:

```
PROMID-RCID:

 ENTER ID OR INDEX OF LLTR
   OR "/" TO ABORT COMMAND--HEY WHY NOT JUST "AB"?
   OR "ALL" FOR ALL LLTR
LLTR  ID, INDEX, ALL, OR /          :
```

For PLAN, the route(s) have to be specified:

```
PRINT -RCID:

 ENTER EITHER ID OR RECORD NUMBER FOR RECORD IN SPED
SPED FILE ID, OR RECORD  :
```

For NBOX, NLIS, NPOS and TGUS, no additional parameters need to be specified.

III.2.8 PROCESS Command

FORMAT: "PR" <clearance altitude> <cr>

or

"PR" <"IN" or "GE" or "ST" or "NO" or "AC" or "AR" or "RO" or "AL" > <cr>

EXAMPLE: PR 3

The PROCESS command causes all of the following algorithms to be executed as required:

GEOMETRY
STATESPACE CLEAR, MASK, ADD AND AOPT
NODES
ACCESS
ARCS
ROUTES
ALLOCATE

The item, IPRO, in the CURR table keeps track of which of the above algorithms need to be executed. The value of this item is increased on a successful PROCESS command so that the algorithms will not have to be executed again. The value of this item is decreased when an ADD, COPY, CHANGE or DELETE command affects one or more of these algorithms. In order to see which algorithms need to be executed, type "HE ST":

A "PR" COMMAND WILL EXECUTE ALL ALGORITHMS WHOSE STATUS IS BAD

ALGORITHM	**STATUS**	**ESTIMATED TIME**
STATESPACE	BAD	TBD
NODES	BAD	TBD
ACCESS	BAD	TBD
ARCS	BAD	TBD
ROUTES	BAD	TBD
ALLOCATE	BAD	TBD

Note that the estimated times in the above excerpt are all "to be determined" (TBD). The current version of the program does not have the necessary code to estimate the times. It is our intention to enhance the FLAPS program to include rough estimates of the CPU time involved.

If the PROCESS command causes the statespace algorithms to be executed, then the optimization altitude must be specified:

```
STATES-AOPT:

 ENTER 1 TO FLY PENETRATORS AT     60. M.
 ENTER 2 TO FLY PENETRATORS AT    120. M.
 ENTER 3 TO FLY PENETRATORS AT    180. M.
 ENTER 4 TO FLY PENETRATORS AT    240. M.
 ENTER 5 TO FLY PENETRATORS AT    300. M.
ALTITUDE OPTIMIZATION LEVEL:
```

There is an alternate method for issuing the PROCESS command, with which planners need not be concerned. If for some reason, the user does not wish to process all the algorithms from statespace to allocate, the PROCESS command may be entered along with an algorithm name as the second paramter.

COMMAND	EFFECT
PR IN	Process initialization
PR GE	Initialization + geometry (if required)
PR ST	Initialization + geometry + statespace (as required)
PR NO	Initialization + geometry + statespace + nodes (as required)
PR AC	Initialization + geometry + ... + access (as required)
PR AR	Initialization + geometry + ... + arcs (as required)
PR RO	Initialization + geometry + ... + routes (as required)
PR AL	Initialization + geometry + ... + allocate (as required)

III.2.9 DISPLAY Command

```
FORMAT:          (For Displays)

         "DI" <options as desired> "/"
              <suboptions as necessary> <cr>

                 (For Scaling)

         "DI" "SC" <"SC" or "ST" or min-lon max-lon min-lat
                                   max-lat> <cr>

EXAMPLES:  DI M WF RO /
           DI WF- RO- D C / ALL STAT D 5
           DI SC ST
           DI SC 13.5 15 58 59.0
```

The DISPLAY command scales and draws displays on a graphical device. The item, IDEV, in the CURR table determines which device -- for planners this item will be set to "4115", so that displays will be drawn on the Tektronix 4115B. Other possible settings include: SEL (Selenar Board), PTX (Printronix), CRT (24 x 80 alphanumeric). To change the device, it is necessary to issue a CHANGE command (Section III.2.6) before the DISPLAY command.

The user must first either select a set of graphical options to be displayed, or type "SC" to indicate that the display is to be re-scaled. The prompt looks like this:

```
DISPLY-OPTN:

ENTER "SC" TO SCALE PLOTTING WINDOW
  OR  "/"  TO DRAW GRAPH  .
  OR NEXT SYMBOL TO TURN ON AN OPTION
  OR SYMBOL FOLLOWED BY "-" TO TURN OFF OPTION
  OR  "P"  TO TURN OFF ALL OPTIONS
SYMBOL  STATUS    DEFINITION
---------------------------------------------
 A                ALTITUDE CONTOURS
 AR       ON      ARCS
 B                BOUNDARY OF GPHC WINDOW
 C        ON      THREAT CIRCLES
 D        ON      DANGER CONTOURS
 E        ON      ENVELOPES
 G                GRID LINES
 I                INDEXES
 L        ON      LONGITUDE/LATITUDE
 LL               LLTRS
 M        ON      MISSION (BDRY + NODES)
 MA               MASKING
 RO       ON      ROUTES
 RZ       ON      ROZS
 ST               STAGING BASES
 SU       ON      SUPPRESSION CIRCLES
 TG               TARGETS
 V                CONTROL VECTORS
 WF       ON      WFZS
CHOOSE OPTIONS or SCale:
```

If "SC" was selected, the user must specify whether the graphical display is to cover the entire scenario, the statespace or a specified longitude-latitude region. If the latter case is chosen, the value for the minimum longitude (in decimal degrees) is entered:

```
PLSCAL-LON1:

 ENTER SC TO SET DISPLAY WINDOW TO ENTIRE SCENARIO
    OR ST TO SET WINDOW TO ENTIRE STATESPACE
    OR ENTER MINIMUM LONGITUDE IN DEGREES
"ST"ATESPACE,"SC"ENARIO or MIN-LONGITUDE:
```

If a minimum longitude was selected, then the other 3 edges of the longitude-latitude region must be specified:

```
PLSCAL-LON2:

 ENTER MAXIMUM LONGITUDE OF WINDOW IN DEGREES
MAX-LONGITUDE:

PLSCAL-LAT1:

 ENTER MINIMUM LATITUDE OF WINDOW IN DEGREES
MIN-LATITUDE:

PLSCAL-LAT2:

 ENTER MAXIMUM LATITUDE OF WINDOW IN DEGREES
MAX-LATITUDE:
```

The set of graphical options to be displayed are selected by typing the appropriate 1 or 2 letter code names and terminating the list of options with a slash. Once an option is selected, it will appear on all succeeding displays until it is turned off. An option may be turned off by typing its code name immediately (with no intervening spaces) followed by a minus. All options may be turned off by typing "P" for purge.

Certain display options require sub-options to be specified after the slash is entered. These sub-options, which are described below, remain in effect and do not have to be retyped until the particular graphical options are "re-selected."

The "re-select" feature allows the user to change sub-option settings. It has the effect of turning the option off and then turning it back on. Re-selecting is done by entering the option in the DISPLAY option list after it has already been selected. If any sub-options need to be specified, the user will be prompted for them again.

The Threat Circle option requires as a sub-option the list of threat models to be displayed:

```
THTYPE-TMDL:

 ENTER ALL TO SELECT ALL MODELS
   OR  /   TO USE CURRENT SELECTION
   OR ENTER A NAME OF A MODEL TO BE ADDED TO LIST
  NAME-STATUS   NAME-STATUS   NAME-STATUS   NAME-STATUS   NAME-STATUS

  SA-1A    -    SA-1B    -    S-SA-1B -     SA-4     -    SA-6     -
  SA-2     -    S-SA-2   -    AAA-1    -    AAA-2    -    SA-11    -
  S-AAA-1 -     S-AAA-2 -     S-SA-11 -     SA-7     -    SA-13    -
  SA-99    -    EW       -    S-EW     -    SA-8     -
CHOOSE THREAT MODEL (ID),ALL or /:
```

The Envelope option requires as a sub-option the list of threat models to be displayed:

```
THTYPE-EMDL:

 ENTER ALL TO SELECT ALL MODELS
   OR  /   TO USE CURRENT SELECTION
   OR ENTER A NAME OF A MODEL TO BE ADDED TO LIST
  NAME-STATUS   NAME-STATUS   NAME-STATUS   NAME-STATUS   NAME-STATUS

  SA-1A    -    SA-1B    -    S-SA-1B -     SA-4     -    SA-6     -
  SA-2     -    S-SA-2   -    AAA-1    -    AAA-2    -    SA-11    -
  S-AAA-1 -     S-AAA-2 -     S-SA-11 -     SA-7     -    SA-13    -
  SA-99    -    EW       -    S-EW     -    SA-8     -
CHOOSE ENVELOPE MODEL (ID),ALL or /:
```

The Suppressor Circle option requires as a sub-option the list of suppression models to be displayed:

```
THTYPE-SMDL:

 ENTER ALL TO SELECT ALL MODELS
   OR  /    TO USE CURRENT SELECTION
   OR ENTER A NAME OF A MODEL TO BE ADDED TO LIST
  NAME-STATUS   NAME-STATUS   NAME-STATUS   NAME-STATUS   NAME-STATUS

  EF-111  -     COMPCALL-
CHOOSE SUPPRESSOR MODEL (ID),ALL OR /:
```

The Arcs option requires as a sub-option the node around which arcs are to be drawn. Only staging base and target nodes are currently supported. Either the node name or the node index may be input. The node name is the eight character name contained in the STGB or TG table, and in the NLIS array. Node indexes are shown by the SH NLIS command, described in Section III.2.7:

```
PROMID-RCID:

 ENTER ID OR INDEX OF NODE
   OR "/" TO ABORT COMMAND
NODE ID, INDEX, or /                :
```

The Routes option requires as a sub-option the particular routes which are to be drawn:

```
PROMPL-RCID:

 ENTER ID OR RECORD NUMBER FOR A SINGLE RECORD IN SPED
  OR ENTER STARTING AND ENDING RECORD NUMBERS SEP-
  ARATED BY SPACE OR COMMA FOR A RANGE OF RECORDS
REC1 "to" REC2 or IDWORD:
```

The Danger option requires several sub-options. First the array to be contoured must be specified:

```
PROMPL-FILE:

 ENTER ALTG TO PLOT OPTIMAL ALTITUDES ABOVE GROUND
       ALTS         OPTIMAL ALTITUDES (MSL)
       CL3D         DANGER FROM CLOBBER
       STAT         TOTAL DANGER AT OPTIMAL ALT
       TH2D         THREAT DANGER AT OPTIMAL ALT
       TH3D         THREAT DANGER AT ANY ALTITUDE

FILE--ALTG,ALTS,CL3D,STAT,TH2D,TH3D:
```

Next the contour levels must be specified:

```
PROMPL-LEVE:

 ENTER VALUE OF FIRST CONTOUR LEVEL
   OR ENTER "D" TO USE DEFAULT LEVELS:
     0.3000    0.2000    0.1000    0.0500    0.0100
NEXT CONTOUR LEVEL, DEFAULT(D), or /:

PROMPL-LEVE:

 ENTER VALUE OF NEXT CONTOUR LEVEL
   OR ENTER "/" TO USE CURRENT SET OF LEVELS:
     0.2800    0.2000    0.1500
   OR ENTER "D" TO USE DEFAULT LEVELS:
     0.3000    0.2000    0.1000    0.0500    0.0100
NEXT CONTOUR LEVEL, DEFAULT(D), or /:
```

Next since these arrays are direction-dependent, the particular flight direction must be specified:

```
PROMPL-DIRE:

 ENTER 0 FOR DANGER AVERAGED OVER ALL 8 DIRECTIONS
       1 FOR DANGER HEADING NORTHWEST
       2                    WEST
       3                    SOUTHWEST
```

```
            4                   SOUTH
            5                   NORTH
            6                   NORTHEAST
            7                   EAST
            8                   SOUTHEAST
    DIRECTION (0=ave or 1-8):
```

Finally if a three-dimensional array (CL3D or TH3D) was chosen, then the altitude must be specified:

```
    PROMPL-ALTT:

     ENTER 1 FOR ALTITUDE=       60. METERS
     ENTER 2 FOR ALTITUDE=      120. METERS
     ENTER 3 FOR ALTITUDE=      180. METERS
     ENTER 4 FOR ALTITUDE=      240. METERS
     ENTER 5 FOR ALTITUDE=      300. METERS
       ALTITUDE LEVEL:
```

After all options and sub-options have been specified, the display is drawn on the selected graphics device.

Once an option is turned on, it is never redrawn unless it is "re-selected". Thus, if changes to the data base have made a graphics option stale, or if the user wishes to change the suboptions for a given option; it is necessary to re-select that option. For example:

```
DI C / SA-6  EW  /
DI C / ALL
```

Here the user displayed the SA-6 and EW threats. Then the user decided to display all of the threats including the ones that are neither SA-6's or EW's. The second DI command overrides the first.

III.2.10 FIND Command

FORMAT: "FI" <"SB" or "TG" or "LL" or "TH" or "SU" or "CO"> <cr>
<move cursor using thumbwheels> <sp>

EXAMPLE: FI SB <move cursor> <sp>

The FIND command is used to find the ID of an object in a graphical display, or to find the location of a point. It should only be entered on a graphics terminal with graphical input capabilities. As of today, this means a Tektronix 4115-B, or a 4125. It should be entered only after a DISPLAY command (Section III.2.9) has been executed, and all the desired graphics options selected. The user must specify what type of object he or she wishes to identify:

```
 FIND  -IDTY:

    TO DETERMINE WHICH OBJECT ID YOU WHICH TO FIND
    ENTER "SB" FOR A STAGING BASE ID
          "TG" FOR A TARGET ID
          "LL" FOR A LLTR ID
          "TH" FOR A THREAT ID
          "SU" FOR A SUPPRESION ID
          "CO" FOR A COORDINATE POINT OR
          "AB" TO ABORT FIND

STGB(SB),TARGETS(TG),LLTRS(LL),THREATS(TH),SUPPRESSOR(SU),
COORDINATE(CO), OR ABORT(AB):
```

Then a cursor appears in the graphical window at the position it was left by the previous Find or LOCATE command (if this is the first such command, at the lower left corner of the window). The user positions the cursor to the desired position using the thumbwheels and hits the space bar. The ID of the nearest object is displayed in the dialog area. The user may continue finding

ID's of the selected option by moving the cursor and hitting the space bar. If the user wishes to change the option (the object to be found), an "S" is entered to select a new option. No carriage return is required while in the graphics input mode. The menu shown above will then reappear. If the user wishes to exit from find, "AB" is entered. A carriage return is required when selecting options from the menu.

III.2.11 MANUAL Command

FORMAT: "MA" <"NEW" or SPED file record id or SPED file record number> <cr> <additional suboptions as required>

EXAMPLE: MA NEW

The MANUAL command is used to create or change a route manually using the graphics capability.

Before entering the MANUAL command, you must be in the graphics mode, i.e. there must be a graphic display on the screen (see the DISPLAY command). After entering "MA", the user receives the following prompt:

```
MANUAL-ROUT:

 DO YOU WISH TO START FROM SCRATCH CONSTRUCTING A ROUTE?  IF SO TYPE IN
"NEW".  IF NOT, DO YOU WISH TO CHANGE AN EXISTING ROUTE THAT IS A RECORD
IN THE SPED FILE?  CHANGE MEANING ADD OR DELETE A WAYPOINT OR LLTR.
TYPE IN THE RECORD NUMBER OF THAT SPED FILE OR THE CHARACTER ID OF THAT
RECORD OF COURSE "A" WILL ABORT MANUAL.

 TYPE IN "NEW", OR A SPED RECORD OR ID:
```

If "NEW" is entered, the user is prompted to enter the staging base ID or index and a target ID or index as shown below. (The staging base and target indexes are contained in the NLIS array.)

```
MANUAL-SBID:
```

INPUT A STAGING BASE ID OR THE INDEX ASSOCIATED WITH IT IN THE NLIS ARRAY. THIS STAGING BASE WILL BE THE STARTING AND ENDING POINT FOR YOUR MANUAL ROUTE.

then:

MANUAL-TGID

INPUT A TARGET ID OR THE INDEX ASSOCIATED WITH IT IN THE NLIS ARRAY. THIS TARGET WILL BE THE POINT YOU WILL BUILD A ROUTE TOWARDS FROM THE GIVEN STGB.

If a SPED record ID in entered, then this is the route that the user will be working with. The user does not need to specify a staging base or target. Now the user is prompted to enter one of the following:

S - Select - selects a waypoint. The waypoint nearest the cursor is selected. The selected waypoint is denoted by a yellow circle around the waypoint symbol.

E - Egress - chooses the Egress route. Any modifications made after this command are made to the Egress route.

I - Ingress - chooses the Ingress route. Any route modifications made after this command are made to the Ingress route.

W - Add Waypoint - add a waypoint. A waypoint is added at the cursor position after the selected waypoint. The new waypoint is connected to adjacent waypoints by a straight line. NOTE: A waypoint cannot be added after the target on an Ingress route or after the staging base on an Egress route.

D - Delete - delete a waypoint. The selected waypoint is deleted. The route is reconnected by a straight line.

O - Optimize - the optimal route between the staging base and the target, through the LLTR exit point closest to the cursor, is drawn.

H - Half Optimize - the optimal route between the staging base and exit LLTR nearest the cursor is drawn.

F - Finish - a prompt appears asking if the user wishes to save the manually created or modified route. If the user wants to save the route, a SPED record id is asked for. The SPED record id may be up to 12 alphanumeric characters long and must begin with a letter. FLAPS will automatically select an id for the user if the user enters a "/". FLAPS then exits the MANUAL mode.

A - Abort - exits the Manual mode but does not save the route.

By using these options and the thumbwheel cursor controls, routes can be generated to and from a target or modifications can be made to an existing route. The new route may then be stored in the SPED table. From there it may be displayed using the DISPLAY command, analyzed for threat exposure using the ANALYZE command, or displayed as a flight plan, using the SHOW PLAN command.

The Ingress and Egress routes cannot be displayed simultaneously while the user is in the MANUAL command mode. To display the entire route, the user must finish the route (the F option), save the route in the SPED table, and then display it using the DISPLAY command.

III.2.12 SELECT Command

FORMAT: "SE" "ALL" <cr>

or

"SE" "/" <target id> <staging base id> <cr>

EXAMPLES: SE ALL
SE / LEGNICA 2
SE / CASLAV RAMSTEIN

The SELECT command causes one or more routes based on the most recent attack aircraft plan to be generated and saved in the SPED table. The user must first specify to select all routes from the current allocation (i.e., those routes in the TGUS array) or a specific route. The following prompt appears:

```
SELECT-ALL/:

 ENTER ALL TO PUT ALL ROUTES
   DETERMINED IN CURRENT ALLOCATION
   IN SPED FILE OR  /  TO CHOOSE AN
   INDIVIDUAL ROUTE TO BE PUT IN SPED FILE

ENTER "ALL" FOR CURRENT ALLOCATION OR "/" FOR INDIVIDUAL ROUTE:
```

If an individual route is desired, then the target and staging base must be specified:

```
PROMID-RCID:

 ENTER ID OR INDEX OF TGT
   OR "/" TO ABORT COMMAND

TGT  ID, INDEX, or /                :

PROMID-RCID:
```

```
ENTER ID OR INDEX OF SB
  OR "/" TO ABORT COMMAND

SB   ID, INDEX, or /             :
```

After the appropriate route or routes have been selected, they may be displayed using the DISPLAY command, analyzed for threat exposure using the ANALYZE command, or displayed as a flight plan on the user's terminal using the SHOW PLAN command.

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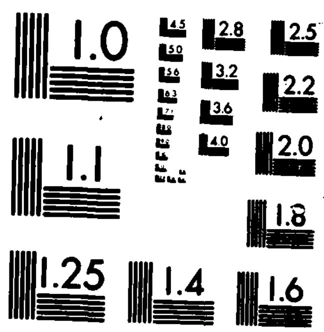
UNCLASSIFIED F/G 15/7 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

III.2.13 ANALYZE Command

FORMAT: "AN" <SPED table record id or record number> <cr>

```
EXAMPLES:  AN BITB.CASL.01
           AN 33
```

The ANALYZE command is used to analyze a route for threat exposure. The route to be analyzed must be in the SPED table, having been put there by either the SELECT or MANUAL commands. The user must specify the route to be analyzed. The user receives the following prompt:

```
ANALIZ-RCID:

 ENTER EITHER ID OR RECORD NUMBER FOR RECORD IN SPED
SPED FILE ID, OR RECORD  :
```

A flight plan is issued for the selected route, with a leg by leg breakdown of the route's probability of survival. Then a listing of each threat encountered on the route, and the contribution of the threat to the route's exposure and danger is shown. This information is based on the array, STAT, so that if a SUPPRESS command has been issued, and has not been followed by a RESTORE command, the analysis will be based on the suppressed statespace. Refer to the examples in Chapter V for a fuller description of the information included in a route analysis.

III.2.14 LOCATE Command

FORMAT: "LO" <move cursor to desired location> <sp> <suppressor type> <suppressor id or "/"> <cr>

EXAMPLE: LO <move cursor to desired location> <sp> EF EF-111.1

The LOCATE command is used to locate or position an EC suppressor in the scenario. It should only be entered on a graphics terminal with graphical input capabilities. As of today, this means a Tektronix 4115-B, or a 4125. It should be entered only after a DISPLAY command has been executed, and all the graphics options which will aid the user in pinpointing the EC suppressor location are displayed.

After entering "LO", a cursor appears in the graphical window at the position it was left by the previous FIND, LOCATE, or MANUAL command (if this is the first such command, the cursor appears at the lower left corner of the window). The user uses the thumbwheels to move the cursor to the desired EC suppressor position and hits the space <sp> bar. The user must then specify the type of EC suppressor to put at this location. The following prompt appears:

```
LOCATE-SMDL:

 ENTER THE FIRST TWO CHARACTERS OF ONE OF
   THE FOLLOWING SUPPRESSION MODELS TO DETERMINE
   THE TYPE OF SUPPRESSOR YOU WANT
   OR ENTER "AB" TO ABORT LOCATE

  NAME       NAME       NAME        NAME

  EF-111     COMPCALL     WILDWEAS

CHOOSE SUPPRESSION MODEL (ID) or "AB" TO ABORT:
```

The ID for the particular EC suppressor must be specified. The following prompt appears:

```
LOCATE-SUID:

  ENTER UP TO AN 8 CHARACTER SUPPRESSOR IDENTIFIER
    OR "/" TO LET THE PROGRAM SELECT AN IDENTIFIER
    FOR YOU OR "AB" TO ABORT LOCATE

ENTER  8 CHAR SUPP ID, "/" FOR PROGRAM SELECTION or "AB"ort:
```

If a slash is entered, the program constructs the ID by taking the first six characters of the Suppression Model ID followed by an underscore character followed by a unique integer (for example, COMPCA.3).

If an ID is entered which the same as that for an existing EC suppressor, the user must then choose either to move that suppressor to a new location or to try again to type a new ID. The following prompt appears:

```
ID IN USE--TYPE "I" TO INPUT NEW ID OR "R" TO RELOCATE ID
```

In any case, the effect of a LOCATE command is to add or change a record in the suppressor table (SUPP). EC suppressor positions may be displayed using the DISPLAY command and the SU option. EC suppressor effectiveness is computed using the SUPPRESS command.

III.2.15 SUPPRESS Command

FORMAT: "SU" <"YES" or "NO"> <cr>

EXAMPLE: SU YES

The SUPPRESS command should be issued after a candidate set of EC suppressors have been located using the LOCATE command. It recalculates the danger for those threats which are in the vicinity of the EC suppression assets. After the user issues the SUPPRESS command, the program first shows a summary of the effectiveness of each suppressor. This summary looks like this:

```
SUPRES - SUPPRESSOR COMPCA.1 (COMPCALL) IN RANGE OF     9.0 FIXED THREATS
                                        AND     0.0 STOCHASTIC THREATS
         CAPACITY IS    20 TOTAL THREATS.
SUPRES - SUPPRESSOR EF-111.1 (EF-111   ) IN RANGE OF     5.0 FIXED THREATS
                                        AND     0.0 STOCHASTIC THREATS
         CAPACITY IS    12 TOTAL THREATS.
SUPRES - SUPPRESSOR COMPCA.2 (COMPCALL) IN RANGE OF    11.0 FIXED THREATS
                                        AND     0.0 STOCHASTIC THREATS
         CAPACITY IS    20 TOTAL THREATS.
```

Then the user must specify whether or not to apply EC suppression based on this summary:

```
SUPRES-CONT:

 SUPPRESSION IS FAIRLY TIME CONSUMING  -- REVIEW
 PREVIOUS LIST OF THREATS AFFECTED BY SUPPRESSORS
 AND DECIDE WHETHER TO APPLY SUPPRESSION

DO YOU WISH TO CONTINUE (YES OR NO) ?:
```

If the decision is to continue, the modified statespace is computed and stored in the array, STAT. The original unsuppressed statespace is still available in the array TH3D. The user may wish to analyze existing routes or graphically redraw danger contours before continuing with the RE-ROUTE command.

III.2.16 RE-ROUTE Command

FORMAT: "RR" <cr>

EXAMPLE: RR

The RE-ROUTE command calculates new routes based on the latest statespace, including EC suppression. It is relatively time consuming operation which involves recalculating all arcs, routes and the attack aircraft allocation. Therefore, it should only be performed once the user is confident that an interesting set of EC suppressors has been located. The RE-ROUTE command requires no additional inputs from the user.

III.2.17 RESTORE Command

FORMAT: "RS" <cr>

EXAMPLE: RS

The RESTORE command restores the statespace, arcs, routes and allocation back to the way they were before EC suppression was applied. In other words, the data base is restored to the way it was before the RR command was executed. It is a relatively time consuming operation which involves resetting the unsuppressed statespace and recalculating all arcs, routes and allocation. Therefore, it should only be performed once the user has obtained all the useful information out of the current set of EC suppressors. The RESTORE command requires no additional inputs from the user.

III.3 SECONDARY COMMANDS

The FLAPS secondary commands are described in this subsection. These are commands which will not be used by most users; they are used primarily by program developers. Most users reading this manual for the first time may skip this section.

While the secondary commands will be used infrequently by the normal user, they are useful. In particular, the SAVE and SPAWN commands are very handy. The COPY command is useful when the user is developing the data bases for a scenario. The following is a list of the secondary commands:

FLAPS SECONDARY COMMANDS

OP	(OPEN)	OPEN AN ARRAY OR TABLE
CO	(COPY)	COPY RECORD WITHIN A TABLE
DB	(DEBUG)	SET DEBUG SWITCH
DR	(DRAW)	DRAW A ROZ AND WFZ POLYGON
IN	(INIT)	INITIALIZE DATA BASE
SA	(SAVE)	SAVE ALL FILES AND CONTINUE EXECUTION
SP	(SPAWN)	SPAWN A BATCH JOB
PA	(PARM)	SHOW CURRENT VALUES OF PARAMETERS

THE FOLLOWING ARE THE INDIVIDUAL ALGORITHMS:

GE	(GEOM)	CALCULATE GEOMETRY
ST	(STAT)	GENERATE STATESPACE
NO	(NODES)	CALCULATE NODES
AC	(ACCESS)	CALCULATE ACCESSIBILITY
AR	(ARCS)	GENERATE OPTIMAL ARCS BETWEEN NODES
RO	(ROUTES)	ROUTES BETWEEN STAGING BASES,TARGETS
AL	(ALLOCATE)	ALLOCATE TIME WINDOWS TO ROUTES

III.3.1 OPEN Command

```
FORMAT: "OP" <table name or array name> <"OLD or "NEW"> <filename>
             <"SR" or "R" or "SR/W" or "R/SW" or "R/W"> <cr>

EXAMPLE:  OP ALGP OLD ALGP.FIL R/W
```

The OPEN command opens one of the tables or arrays needed by FLAPS. It is normally issued from within a command file, rather than interactively by a user. For example, most users will respond "Y" to the prompt to read in previous FLAPS files as described in Section II.1. This response causes the command file ZCONTNU.DAT to issue the open commands for all the files that the most users will need during a FLAPS session.

After an interactive user issues an OPEN command, the user must specify which table or array is to be opened. The prompt has the following form:

```
CROPEN-NAME:

  ENTER "BYTE" TO OPEN BYTE-PACKED TERRAIN FILE
      OR "CHRT"         CHARACTERIZED TERRAIN FILE
      OR 4-CHARACTER TABLENAME:

  NAME       TITLE

  TSTR   TABLE STRUCTURE
  ASTR   ARRAY STRUCTURE
  ALGP   ALGORITHM PARAMS
  CMDL   CLOBBER MODEL
  CURR   CURRENT STATUS
  DISP   DISPLAY PARAMS
  GEOM   COORD TRANSFMTN
  LLTR   LLTR NODE PARAMETERS
  NODP   NODE PARAMETERS
  PBOR   POLITICAL BORDERS
  ROZ    RESTRICTED OPERATING ZONES
  SPED   SORTIE RECORDS
  STCH   STOCHASTIC REGIONS
  STGB   STAGING BASE PARAMS
  SUPM   SUPPRESSION MODELS
  SUPP   SUPPRESSOR TYPE
```

```
SWCH   VARIOUS SWITCHES
TG     TARGET PARAMS
THRT   THREAT LOCATIONS
TMDL   THREAT MODELS
VEHP   VEHICLE PARAMETERS
WEAP   WEAPON PARAMETERS
WFZ    WEAPON FREE ZONES

 OR ENTER 4-CHARACTER ARRAYNAME:

NAME        TITLE

ACCL    LP ACCESSIBLE TO TCOM
ACCN    ACCESSIBLE NODES
ACCR    TCOM ACCESSIBLE TO TCOM
ALTG    ALTITUDE ARRAY
ALTS    ALTITUDE ARRAY
ARCS    ARC WAYPOINT ARRAY
ARPE    TARG INGRESS/EGRESS PERF
CL3D    CLOBBER MODEL FOR 3-D
ITGC    TARG ACCESSIBLE TO STGB
ITRC    TREX ACCESSIBLE TO TREN
MASK    TERRAIN MASKING
NBOX    LIST OF TG BOX CORNERS
NLIS    LIST OF NODES
NPOS    NODE POSITIONS
ROUT    ROUT NODES DIST AND PERF
STAT    STATESPACE
SXPE    STGB TO LLTR EXIT PERF
TGUS    TARGET STATUS ARRAY
TH2D    TWO-D THREAT DANGER
TH3D    THREE-D THREAT DANGER
TOBS    THREAT OBSERVABILITY
TRPE    LLTR TREE PERFORMANCE

   ARRAY or TABLE NAME:
```

The user is then prompted to specify whether this is an old, existing file or a new file to be created:

```
CROPEN-STUS:

OLD or NEW:
```

Then the filename must be specified:

```
CROPEN-FILE:

FILENAME:
```

And the user must specify the type of access required:

```
CROPEN-ACCS:

 ACCESS-LEVEL FOR THIS FILE:
   SR:     SOFTWARE READ--CANNOT SHOW OR CHANGE
   R:      READ--CAN SHOW BUT CANNOT CHANGE
   SR/W:   SOFTWARE READ/WRITE--ONLY ALGORITHMS CAN CHANGE
   R/SW:   READ/SOFTWARE WRITE--CAN SHOW, BUT ONLY ALGS CAN CHANGE
   R/W:    READ/WRITE--CAN SHOW,ADD,DELETE,CHANGE,COPY
ACCESS--SR.R,SR/W,R/SW or R/W:
```

Most planners need not use the OPEN command.

III.3.2 COPY Command

FORMAT: "CO" <table name> <record id or record number>

<new record id> <cr>

EXAMPLE: CO THRT 2 NEWID

The COPY command copies one record in a table to a new record in the same table. All the information in the new record except for the ID is identical to that in the old record. The user must first specify the table. The prompt looks like this:

```
CRCOPY-TABL:
 ENTER NAME OF TABLE TO BE MODIFIED:
 NAME       TITLE

 TSTR   TABLE STRUCTURE
 ASTR   ARRAY STRUCTURE
 ALGP   ALGORITHM PARAMS
 CMDL   CLOBBER MODEL
 CURR   CURRENT STATUS
 DISP   DISPLAY PARAMS
 GEOM   COORD TRANSFMTN
 LLTR   LLTR NODE PARAMETERS
 NODP   NODE PARAMETERS
 PBOR   POLITICAL BORDERS
 ROZ    RESTRICTED OPERATING ZONES
 SPED   SORTIE RECORDS
 STCH   STOCHASTIC REGIONS
 STGB   STAGING BASE PARAMS
 SUPM   SUPPRESSION MODELS
 SUPP   SUPPRESSOR TYPE
 SWCH   VARIOUS SWITCHES
 TG     TARGET PARAMS
 THRT   THREAT LOCATIONS
 TMDL   THREAT MODELS
 VEHP   VEHICLE PARAMETERS
 WEAP   WEAPON PARAMETERS
 WFZ    WEAPON FREE ZONES

TABLE NAME:
```

The user is then prompted to specify the record to be copied.

```
CRCOPY-RCID:

 ENTER EITHER ID OR RECORD NUMBER FOR RECORD IN THRT
FROM RECORD NUM or IDWORD:
```

Next specify the ID of the new record:

```
CRCOPY-NWID:

 ENTER NEW ID OF COPIED RECORD
TO IDWORD:
```

Most planners need not use the COPY command.

III.3.3 DEBUG Command

FORMAT: "DB" <debug level> <cr>

EXAMPLE: DB 5

The DEBUG command sets an internal program variable which determines how much debug output is produced by the program. The user must specify the level, by responding to the following prompt:

```
CRDBUG-LEVL:

 ENTER DEBUG LEVEL (0 TO 9)--CURRENTLY= 5
DEBUG LEVEL -- 0 to 9:
```

A level of 0 implies no debug output; a level of 1 means only the elapsed CPU time and wall clock time associated with each command is produced. Higher levels produce a greater quantity of debug output. Planners need not use this command, since the ZCONTNU.DAT command file discussed in Section II.1 will set the debug level to a moderate value such as 5.

III.3.4 DRAW Command

FORMAT: "DR" <cr> <"W" or "R"> <move cursor to desired location>
<space bar> etc. "F" <record id>

EXAMPLE: DR <cr> W <space bar> <space bar> <space bar> F WFZAREA <cr>

The DRAW command is used to create polygonal avoidance areas. The avoidance area may be a WFZ area (denoted by red lines) or an ROZ area (denoted by purple lines). Currently these areas do not affect routes, however, in a future version of FLAPS, avoidance areas will affect routes.

The DRAW command should only be entered on a graphics terminal with graphical input capabilities. As of today, this means a Tektronix 4115-B or a 4125. It should be entered only after a DISPLAY command (Section III.2.9) has been executed, and all the desired graphics options selected. After entering "DR", the user receives the following prompt:

```
DRAWPO-POLY:
  HELP IS NOT YET AVAILABLE
 DO YOU WISH TO BUILD A WFZ(W) or ROZ(R) POLYGON?:
```

After responding to the above prompt, the user moves the cursor to the place on the display where he or she wishes to begin the polygon. The user is prompted to enter one of the following commands:

space bar - Continue - sets the coordinates of the polygon. Adds a new vertex to the polygon at the location of the cursor. Up to 8 points may be entered. The coordinates are connected by straight lines, red for WFZ and purple for ROZ.

F - Finish - closes the polygon. At least 3 coordinates must be entered in order to complete the polygon. The user is prompted to enter a character ID (up to 3 alphanumeric characters, but must begin with a letter) or "AB" to abort.

D - Delete - deletes the last vertex of the polygon, and redraws the remaining vertices.

A - Abort - exits the DRAW command mode, but does not save the polygon.

By using these options and the thumbwheel cursor controls, the user can generate a new WFZ or ROZ and automatically store it in the FLAPS data base.

III.3.5 INITIALIZE Command

FORMAT: "IN" <cr>

EXAMPLE: IN

The INITIALIZE command initializes the file management programs within FLAPS. The command is issued twice -- once for tables, once for arrays. Planners need not be concerned with this command since the ZCONTNU.DAT command file discussed in Section II.1 will also issue this command.

III.3.6 SAVE Command

FORMAT: "SA" <cr>

EXAMPLE: SA

The SAVE command flushes all buffers, closes the experiment log file (FOR004.DAT), opens a new version of the experiment log and continues FLAPS execution. The SAVE command is useful for protecting the data base. It is suggested that Save be executed periodically after significant processing has been performed. This will protect the user's results from "system crashes" or "abnormal terminations" of the program. Because the statespace and arcs generation steps are time consuming, it is recommended that Save be run after those operations.

III.3.7 SPAWN Command

FORMAT: (For a single VAX system command)

"SP" <cr> <any VAX system command>

FORMAT: (For multiple VAX system commands)

"SP" <cr> "SP" <cr> <VAX system commands> "LOGOUT" <cr>

EXAMPLE: SP<cr> DIR FOR004.DAT

The SPAWN command allows the user to interrupt FLAPS execution to issue one VAX system command. For example, using the SPAWN command, the user may edit, type, print, or do a directory listing on the VAX. Upon completion of the VAX system command, FLAPS execution is resumed. If the VAX system command was itself a SPAWN command, then FLAPS execution is not resumed. In this case, VAX system commands may be issued until "LOGOUT" is typed. At that point, FLAPS execution is resumed. Planners need not be concerned with the SPAWN command.

III.3.8 PARAMETER Command

FORMAT: "PA" <cr>

EXAMPLE: PA

The PARAMETER command generates a listing of the descriptions and values of certain FLAPS parameters. These parameters are the dimensions used for various internal storage vectors. Planners need not be concerned with this command.

III.3.9 GEOMETRY Command

FORMAT: "GE" <cr>

EXAMPLE: GE

The GEOMETRY command calculates geometrical parameters. Specifically, it converts the user-friendly information in the ALGP table to the program-friendly information in the GEOM table. Planners should not issue this command, since the PROCESS command (Section III.2.8) automatically performs this function whenever it is required.

III.3.10 STATESPACE Commands

```
  FORMAT:  (For Clearing Statespace)

           "ST" "CL" <"CL3D" or "TH3D" or "TOBS"> <"0" or "/"> <cr>

            (For Masking Threats)

           "ST" "MA" <record id or record number of first threat to mask>
                (<record number of last threat to mask>) <cr>

            (For Adding or Deleting Threats to the Statespace)

           "ST" <"AD" or "DE"> <"THRT" or "STCH">
                <record id or record number of first threat to add>
                (<record number of last threat to add>) <cr>

            (For Selecting Penetrator Altitude)

           "ST" "AO" <clearance altitude> <cr>

EXAMPLES:  ST CL TH3D /
           ST MA 2 99
           ST AD THRT TH01
           ST AD THRT 2 999
           ST AO 3
```

The STATESPACE command maintains the statespace. Planners should not issue this command, since the PROCESS command (Section III.2.8) automatically performs this function whenever it is required.

If a STATESPACE command is issued, the user must specify which STATESPACE sub-command is to be performed. The prompt looks like this:

```
STATES-OPTN:

 ENTER "CL" TO CLEAR A STATESPACE FILE
       "AL" TO COMPUTE ALTERR ARRAY (NOT YET CODED)
       "MA" TO COMPUTE MASKING FOR 1 OR MORE THREATS
       "AD" TO ADD THE DANGER FROM 1 OR MORE THREATS
       "DE" TO DELETE THE DANGER FROM THREATS
       "GC" TO COMPUTE GROUND CLOBBER (NOT YET CODED)
       "AO" TO PERFORM ALTITUDE OPTIMIZATION
CLea,ADd,DEle,MAsk,GC"clob",AOpt,ALt:
```

The CLEAR subcommand is used to clear one of the arrays created by the STATESPACE command to its initial value. The user must specify which array is to be cleared, by responding to the following prompt:

```
STATES-ARAY:

 ENTER "CL3D" TO CLEAR 3-D CLOBBER SPACE       (not currently used)
       "TH3D"          3-D THREAT SPACE
       "TOBS"          LIST OF MASKED THREATS

CL3D, TH3D, TOBS:
```

For TH3D and CL3D, the initial value for that array must be specified.

```
STATES-VALU:

 ENTER VALUE TO CLEAR ARRAY TO

   OR "/" TO USE DEFAULT= 1.550E-04

    0 IS NORMAL FOR CL3D,TOBS;  / FOR TH3D

STATESPACE VAL (/=FLAMAP):
```

A value of 0.0 is automatically used for the TOBS array. The CL3D array is not currently used by FLAPS and the user should not specify it as an option. The user may clear it to any value, but it will have no effect on the program.

The MASK subcommand performs terrain masking on one or more fixed threats. This subcommand uses the MASK array as temporary storage, and puts the results of masking into the TOBS array. The user must specify the fixed threat(s) to be masked. The prompt looks like this:

```
PROMRC-RCID:

 ENTER ID OR RECORD NUMBER FOR A SINGLE RECORD IN THRT
```

```
  OR ENTER STARTING AND ENDING RECORD NUMBERS SEP-
  ARATED BY SPACE OR COMMA FOR A RANGE OF RECORDS
REC1 "to" REC2 or IDWORD:
```

The ADD and DELETE subcommands add or delete the effects of one or more fixed or stochastic threats into the three-dimensional statespace TH3D. The user must first specify the type of threat desired. The following prompt appears:

```
STATES-TABL:

 ENTER "THRT" IF FIXED THREATS ARE REQUIRED
       "STCH" IF STOCHASTIC THREATS
THRT or STCH?:
```

The threats to be added or deleted must be specified. The prompt looks like this:

```
PROMRC-RCID:

 ENTER ID OR RECORD NUMBER FOR A SINGLE RECORD IN THRT
  OR ENTER STARTING AND ENDING RECORD NUMBERS SEP-
  ARATED BY SPACE OR COMMA FOR A RANGE OF RECORDS
REC1 "to" REC2 or IDWORD:
```

The ALTITUDE OPTIMIZATION command computes the optimal altitude at which penetrators are to fly. Currently this is done by having the user specify the altitude from the selection of altitudes included in the ALGP table. Future versions of the program may compute this altitude automatically by trading the probability of ground clobber at low altitudes against the probability of attrition at high altitudes. In any case, the danger at the optimal altitude is written to the STAT array.

The user currently selects the optimal altitude by responding to the following prompt:

```
STATES-AOPT:

 ENTER 1 TO FLY PENETRATORS AT     60. M.
 ENTER 2 TO FLY PENETRATORS AT    120. M.
 ENTER 3 TO FLY PENETRATORS AT    180. M.
 ENTER 4 TO FLY PENETRATORS AT    240. M.
 ENTER 5 TO FLY PENETRATORS AT    300. M.
ALTITUDE OPTIMIZATION LEVEL:
```

III.3.11 NODES Command

FORMAT: "NO" <cr>

EXAMPLE: NO

The NODES command prepares a list of nodes -- staging bases, low level transit routes and targets. It also calculates the LLTR trees -- that is the sequence of low level transit routes which connect each entry LLTR to each reachable exit LLTR. The list of nodes and their positions are written to the arrays NLIS and NPOS. The LLTR trees and their performance measures are written to the arrays ITRC and TRPE.

Planners should not issue this command, since the PROCESS command (Section III.2.8) automatically performs this function whenever it is required.

III.3.12 ACCESSIBILITY Command

FORMAT: "AC" <cr>

BLANK

EXAMPLE: AC

The ACCESSIBILITY command determines which target/staging base pairs are accessible to each other. This determination is based on distance of flight, the available LLTRs, the aircraft types, and applicability of weapons to targets. The accessibility lists are written to the ITGC array; the performances from the staging bases to the exit LLTRs are written to the SXPE array; and the boxes around each target to be used in the arcs generation function are written to the NBOX array.

Planners should not issue this command, since the PROCESS command (Section III.2.8) automatically performs this function whenever it is required.

III.3.13 ARCS Command

FORMAT: "AR" <cr>

EXAMPLE: AR

The ARCS command calculates the optimal Ingress arcs to each target from each accessible LLTR exit point and the optimal Egress arcs from each target to each accessible LLTR exit point. This calculation is very time consuming since it requires the dynamic programming algorithm to be executed to calculate the paths which minimize danger from threats. The waypoints on the arcs are written to the ARCS array. The performance of the arcs to the ARPE array.

Planners should not issue this command, since the PROCESS command (Section III.2.8) automatically performs this function whenever it is required.

III.3.14 ROUTES Command

FORMAT: "RO" <cr>

EXAMPLE: RO

The ROUTES command finds the optimal Ingress and Egress routes between each target and accessible staging base. The performance of each such route is written to the ROUT array. The actual waypoints on these routes are not generated until the SELECT command (Section III.2.12) is issued.

Planners should not issue this command, since the PROCESS command (Section III.2.8) automatically performs this function whenever it is required.

III.3.15 ALLOCATE Command

FORMAT: "AL" <cr>

EXAMPLE: AL

The ALLOCATE command allocates aircraft and weapons to the targets. It determines how many aircraft should be assigned to each target, the standard configuration loads for the aircraft, and the staging base from which the aircraft should be flown and recovered. This calculation is performed in the absence of suppression. The results are stored in the TGUS array.

Planners should not issue this command, since the PROCESS command (Section III.2.8) automatically performs this function whenever it is required.

CHAPTER IV

FLAPS DATA STRUCTURES

There are two types of data structures in FLAPS: Tables and Arrays. Tables are record-oriented data structures which are under the direct control of the user. Tables may be accessed by the ADD, CHANGE, COPY, DELETE and SHOW commands discussed in Chapter III. Arrays are matrix-oriented data structures which are created and maintained by the FLAPS software. Some of the arrays may be accessed by the Show command. Typically arrays contain a much greater quantity of data than tables. Sections IV.1 and IV.2 describe the structure and contents of the FLAPS tables and arrays.

IV.1 TABLES

There are 22 tables defined in FLAPS. The names and descriptions of the tables are given below. Those tables which are of the greatest interest to planners are marked with an asterisk. The remaining tables, while important, will only occasionally be of interest to the planners. Many of these tables are

created when the data base is first initialized, and then never change. For the FLAPS prototype system, this will be done when the software is installed at USAFE Headquarters. These tables include TSTR, ASTR, and SWCH. Other tables are created by the software. The user is not responsible for creating or maintaining these tables. However, he may wish to show the contents of these tables. Each four-character table name is associated with a random access disk file (see the OPEN command in Section III). These disk files each consist of two or more fixed length records.

NAMES AND DESCRIPTIONS OF TABLES

TSTR	TABLE STRUCTURE
ASTR	ARRAY STRUCTURE
ALGP *	ALGORITHM PARAMETERS
CURR	CURRENT STATUS
DISP	DISPLAY PARAMETERS
GEOM	COORDINATE TRANSFORMATIONS
LLTR *	LLTR NODE PARAMETERS
NODP	NODE PARAMETERS
PBOR	POLITICAL BORDERS
ROZ	RESTRICTED OPERATING ZONES
SPED	SORTIE RECORDS
STCH *	STOCHASTIC REGIONS
STGB *	STAGING BASE PARAMETERS
SUPM *	SUPPRESSION MODELS
SUPP *	SUPPRESSOR TYPE
SWCH	VARIOUS SWITCHES
TG *	TARGET PARAMETERS
THRT *	FIXED THREAT LOCATIONS
TMDL *	THREAT MODELS
VEHP *	VEHICLE PARAMETERS
WEAP	WEAPON PARAMETERS
WFZ	WEAPON FREE ZONES

* tables of greatest interest to planners

The first record of each table is a header record. This record contains information used by the file management software, and is unimportant to the user. Data which is stored in a table begins in record 2. Some tables, such as the Algorithm Parameter (ALGP) Table have only two records. Other tables, such as the Threat Location (THRT) Table have as many as 200 records. Within a table, the structure of each record is the same; that is, the records are all of identical length and are organized into the same sequence of items. For example, the following excerpt shows the contents of the first two records (after the header record) and the last record in the THRT table. Each record (except the header record) corresponds to a single fixed threat. The same information, organized in the same fashion, exists for each threat.

```
CRSHOW -- RECORD #   2    IDWORD=S601
          ID  =    S601
          ITYP=    SA-6
          XTH = 1.2082E+01 5.0615E+01 3.0500E+00
          PEX = 1.0000E+00
          IDC =    85/11/22 16:43
          IDM =    85/11/22 16:43
CRSHOW -- RECORD #   3    IDWORD=S602
          ID  =    S602
          ITYP=    SA-6
          XTH = 1.2197E+01 5.0427E+01 3.0500E+00
          PEX = 1.0000E+00
          IDC =    85/11/22 16:43
          IDM =    85/11/22 16:43
CRSHOW -- RECORD #  98    IDWORD=S815
          ID  =    S815
          ITYP=    SA-8
          XTH = 1.2128E+01 5.1260E+01 3.0500E+00
          PEX = 1.0000E+00
          IDC =    85/11/22 16:43
          IDM =    85/11/22 16:43
```

The THRT table has six items. Each item has a one to four character name (ID, ITYP, etc.). Notice that some items, such as ID, correspond to one element of data (a scalar item); while other items, such as XTH, correspond to more than one element (a vector item). Each item is designated as character, integer or real. Mixed data types may not be associated with a single item.

The item structure of a record is very useful for manipulating the contents of the record. The first item in each record is the ID of the record. The ID is of character data type. A record may be accessed by its integer record number or by its character ID. The use of these two methods of accessing a record are discussed under the various data base commands in Chapter III.

The last two items of a record in each FLAPS table are the creation date (IDC) and modification data (IDM) of the record. These two items cannot be manipulated by the user. These items are changed internally by the FLAPS software. However, the user can display the IDC and IDM values using the Show command. The IDC and IDM values are displayed as integers so that dates may be easily compared to see which one is later. The format is 'YY/MM/DD HH:MM'. Thus, for example, the last record in the THRT table above was created and modified at 16:43 on November 22, 1985 (IDC = IDM = 85/11/22 16:43).

IV.1.1 TSTR: Table Structure Table

The TSTR table contains the information defining the structure of all the other FLAPS tables. Each record in TSTR describes one of the other FLAPS tables. TSTR is created by the program during a special initialization run in which the file ZDEFINE.DAT is read. The current version of ZDEFINE.DAT is included in Appendix C. This run is "transparent" to the user in that the user sees only the result of the run and neither directly initiates nor sees the run itself. The user should never attempt to ADD, DELETE, CHANGE or COPY the TSTR table.

The structure of the TSTR Table is shown below. This excerpt may be recreated by typing "SHOW TSTR HELP".

TSTR TABLE STRUCTURE

NAME	TYPE	SIZE	LOC	TITLE
NAMT	CH04	1	1	TABLE NAME
NXRC	INT	1	2	MAXIMUM RECORDS
IAFT	INT	1	3	EFFECT OF CHANGING TABLE
NIT	INT	1	4	NUMBER OF ITEMS
ITIT	CH24	1	5	TITLE OF TABLE
NAMI	CH04	80	11	ITEM NAMES
ITYP	CH04	80	91	ITEM TYPES
ISIZ	INT	80	171	ITEM SIZES
ITTL	CH24	80	251	TITLE OF ITEMS
IDEF	INT	80	731	DEFAULTABLE ITEM FLAG
IACC	INT	80	811	ITEM ACCESS CLASS
IEDT	INT	80	891	ITEM EDIT TYPE
PAR1	REAL	80	971	ITEM LOWER LIMIT
PAR2	REAL	80	1051	ITEM UPPER LIMIT
IAFI	INT	80	1131	EFFECT OF CHANGING ITEM
IDC	TIME	1	1211	CREATION DATE
IDM	TIME	1	1212	MODIFICATION DATE

The first item is the record ID (NAMT) -- it is the same as the name of the table which this record describes ('ASTR', 'ALGP', etc.). The next item (NXRC) is the maximum number of records allowed in the table, including the header record. The affect (IAFT) code is an integer whose meaning is described in the section on the CURR table (IV.1.4). Then comes the number of items in the table (NIT) and a 24 character title for the table (ITIT). The next ten items are each of size 80, and describe the individual items within the table. Thus the number of items in any table must not exceed 80. NAMI is the one to four character name of the items; ITYP is the data type ('REAL', 'INT ', 'TIME' or 'CHnn', for a character item whose element length is nn characters). ITTL is a 24 character description of the item. IDEF is not currently implemented. IACC has the value of 0 for almost all items, but has the value of -5 for those few items which are not accessible to the user in ADD or CHANGE commands. IEDT, PAR1, PAR2 and IAFI are not currently implemented.

31

IV.1.2 ASTR: Array Structure Table

The ASTR table contains the information which defines the structure of every FLAPS array. Each record in ASTR describes one of the FLAPS arrays. ASTR is created by the program during a special initialization run, in which the file ZDEFAR.DAT is read. This run is "transparent" to the user in that the user sees only the result of the run and neither directly initiates nor sees the run itself. The current version of ZDEFAR.DAT is included in Appendix B. The user should never attempt to ADD, DELETE, CHANGE or COPY the ASTR table.

The structure of the ASTR table is shown below. This excerpt may be recreated by typing "SHOW ASTR HELP".

ASTR TABLE STRUCTURE

NAME	TYPE	SIZE	LOC	TITLE
NAMA	CH04	1	1	ARRAY NAME
NXRC	INT	1	2	MAX NUMBER OF RECORDS
ITIT	CH24	1	3	TITLE OF ARRAY
IDC	TIME	1	9	RECORD CREATION DATE
IDM	TIME	1	10	RECORD MODIFICATION DATE

The first item is the record ID (NAMA) -- it is the same as the name of the array which this record describes ('ARCS', 'ARPE', etc.). The next item (NXRC) is the maximum number of records allowed in the array, including the header record. ITIT is a 24 character title for the array.

IV.1.3 ALGP: Algorithm Parameters Table

The ALGP table defines the scenario and the statespace. This includes the geographic region over which the scenario is defined, and the statespace quantization level (cell size). Record 2 of this table must be properly defined before any processing starts.

IV.1.3.1 ALGP TABLE USAFE

The structure of the ALGP table is shown below. This table can be created by typing "SHOW ALGP HELP".

ALGP TABLE STRUCTURE

NAME	TYPE	SIZE	LOC	TITLE
ID	CH04	1	1	ID = ALGP
DELE	REAL	1	2	LONGITUDE GRID(NM)
DELN	REAL	1	3	LATITUDE GRID(NM)
XMIN	REAL	1	4	MIN LON OF STATESPACE
XMAX	REAL	1	5	MAX LON OF STATESPACE
YMIN	REAL	1	6	MIN LAT OF STATESPACE
YMAX	REAL	1	7	MAX LAT OF STATESPACE
NALT	INT	1	8	NUMBER OF ALTITUDES
NDIR	INT	1	9	NUMBER OF DIRECTIONS
IDUM	INT	1	10	# OF MASKING POINTS
IDVE	CH04	1	11	VEHICLE NAME FOR STATES
ARMX	REAL	1	12	LAMDA - AIR DAMAGE
FLAM	REAL	1	13	LAGRANGE MULTIPLIER
ALTS	REAL	5	14	ALTITUDE GRID (M)
XSCL	REAL	1	19	MIN LON OF SCENARIO
XSCU	REAL	1	20	MAX LON OF SCENARIO
YSCL	REAL	1	21	MIN LAT OF SCENARIO
YSCU	REAL	1	22	MAX LAT OF SCENARIO
PCAP	REAL	5	23	PROB OF CLOBBER GRID
IDC	TIME	1	28	RECORD CREATION DATE
IDM	TIME	1	29	RECORD MODIFICATION DATE

The first item in the table is the ID which is always equal to ALGP. The next two items define the statespace cell size. DELE is the longitude increment and DELN is the latitude increment. Typically these two numbers are equal. Currently the values are both 2.4 nautical miles. The next four items define the statespace. XMIN and YMIN are the longitude and latitude of the southwest corner of the statespace. XMAX and YMAX define the northeast corner. As is standard for all the tables, the values are in decimal degrees; longitude is positive east and latitude is positive north. NALT is the number of altitude levels that will be used in constructing the three dimensional statespace (TH3D). NALT may be as low as 1 and should never exceed 5. It is currently set to 5. NDIR is the number of directions used in generating the statespace. It must be set to 8 for this version of FLAPS. This corresponds to a 45 degree angular separation of adjacent directions. IDUM is the number of masking points and should be set equal to 2. IDVE is the ID of the vehicle for which the statespace is to be built. IDVE must match an ID for one of the Vehicle Parameters table (VEHP) records. The statespace will be built assuming that all vehicles are flying at the nominal velocity (VNOM in VEHP) for the vehicle specified by IDVE. ARMX is the air danger per second. It is applied to all transition costs in the statespace. A vehicle flying through enemy airspace is at risk even if it is not within the coverage of any known threats. FLAPS models this risk with ARMX. It should always be a very small number. FLAM is the Lagrange multiplier which is used to ensure that the routes generated by the dynamic programming algorithm are direct and fuel efficient. It is also in the units of danger per second. ALTS is the list of above ground level clearance altitudes that are used in building the statespace. The altitudes are in meters. In building TH3D, threat exposure is calculated for each of these

altitudes, for every threat. The first NALT values should be greater than 0. The variables XSCL, XSCU, YSCL, and YSCU, define the scenario. XSCL, and YSCL are the longitude and latitude of the southwest (lower) corner of the scenario. XSCU and YSCU are the longitude and latitude of the northeast (upper) corner of the scenario. The scenario must contain the statespace. PCAP is the "constant probability of clobber grid" and is not now being used.

IV.1.3.2 ALGP Table Usage

The ALGP table defines both the scenario space and the statespace. It is critical that it be defined properly or else the threat modeling calculations, which are very time consuming relative the the rest of FLAPS, will be incorrect. The normal user should never have to change the values of ALGP. However, if that becomes necessary, the following information will be useful.

Please note that the statespace must be completely contained within the scenario space. The statespace must also be completely contained within the boundaries of the byte packed terrain data (BYTE) file. Please see Sections IV.2.13, IV.2.10, and IV.2.17 for desciptions of TH3D, STAT, and BYTE.

The statespace contains what are called "transition costs". A transition cost is defined to be the negative log of the probability of survival going from one cell to another. The negative log probability of survival is often referred to as "danger." Because each cell is connected to eight other cells, there are eight transition costs per statespace cell. Threat lethalities are stored in the threat model table (TMDL) in the form of negative log probability of survival per second. To calculate a transition cost from a TMDL record

requires, among other factors, that the danger per second be multiplied by the amount of time it takes to fly from one cell to another. At this time, the FLAPS statespace is built for only one vehicle. This is in spite of the fact that planning is being performed for several vehicle types. Currently it is assumed that the differences in speed and threat capability between the F-4, F-16, and F-111 are small. The item IDVE is the ID of the vehicle for which the statespace will be built.

Routes generated using the dynamic programming algorithm are sensitive to the values of ARMX and FLAM. The current values, 5.0 E-6 and 1.5 E-4 respectively, are appropriate for the force level planning application. SCT recommends that the user not change these parameters.

IV.1.4 CURR: Current Status Table

The CURR table consists of a single record of data. This record describes the current status of processing. CURR is updated by the program as a result of a PROC command, or an ADD, DELETE, CHANGE or COPY command to any other table. The user should never attempt to ADD, DELETE or COPY the CURR table. The user should CHANGE the table only to change the graphical plotting device.

The structure of the Current Status Table is shown below. This excerpt may be recreated by typing "SHOW CURR HELP".

CURR TABLE STRUCTURE

NAME	TYPE	SIZE	LOC	TITLE
ID	CH04	1	1	ID = CURR
IADD	INT	1	2	# OF THREATS ADDED
IALT	INT	1	3	TERRAIN ALT INIDCATOR
IAOP	INT	1	4	ALTITUDE LEVEL
ICLO	INT	1	5	CLOBBER INDICATOR
ISTO	INT	1	6	# OF STCH THREATS ADDED
ILST	CH04	1	7	LAST COMMAND GIVEN
INDX	INT	1	8	INDEX OF LAST ARC DONE A
IPRO	INT	1	9	STATUS OF PROC COMMAND
ITYP	INT	1	10	TYPE OF LAST ARC DONE A
IMSK	INT	1	11	# OF THREATS MASKED
IDEV	CH04	1	12	INDEX OF LAST ARC DONE T
IDM1	INT	1	13	DEVICE CHARACTER
IDM2	INT	1	14	DUMMY NOT YET USED
IDM3	INT	1	15	DUMMY NOT YET USED
IDM4	INT	1	16	DUMMY NOT YET USED
IDM4	INT	1	17	DUMMY NOT YET USED
IDM5	INT	1	18	DUMMY NOT YET USED
IDM6	INT	1	19	DUMMY NOT YET USED
IDM7	INT	1	20	DUMMY NOT YET USED
IDM8	INT	1	21	DUMMY NOT YET USED
IDM9	INT	1	22	DUMMY NOT YET USED
IDM0	INT	1	23	DUMMY NOT YET USED
IDC	TIME	1	24	RECORD CREATION DATE
IDM	TIME	1	25	RECORD MODIFICATION DATE

The first item is the record ID and is always equal to CURR. Of the remaining items, only IAOP, IPRO and IDEV are currently used by the program. IAOP is the altitude level used in the altitude optimization algorithm of statespace construction. The user specifies this level in response to a prompt issued by the STATES AOPT and PROC commands as described in Chapter III. IDEV is the plotting device currently in use, as described in the DISPLAY command of Chapter III. IPRO is the status of processing as defined below.

```
IPROCU  = "STATUS OF PROCESSING"

          "=  0:  GEOMETRY TO BE DONE"
          "=100:  GEOMETRY OK;  STATESPACE TO BE CLEARED"
          "=120:  STATESPACE CLEARED;  MASKING TO BE DONE"
          "=140:  MASKING COMPLETE:  THREATS TO BE ADDED"
          "=150:  THREATS ADDED:  STCHS TO BE ADDED"
          "=160:  STCHS ADDED;  CLOBBER TO BE DONE"
          "=180:  CLOBBER OK;  AOPT TO BE DONE"
          "=200:  STATESPACE OK;  NODES TO BE DONE
          "=250:  NODES OK;  ACCESS TO BE DONE"
          "=300:  ACCESS OK;  ARCS TO BE COMPLETED"
          "=400:  ARCS OK;  ROUTES TO BE DONE"
          "=500:  ROUTES OK;  ALLOCATE TO BE DONE"
          "=600:  ALLOCATE OK"
```

IV.1.4.1 CURR Table Usage

The CURR table is changed by the user using the standard table CHANGE command. Only the IDEV item should be selected for changing. Possible values for this item depend on the available hardware configuration. Because the data type of this item is character, values like 4014 and 4115 which are normally treated as integers must be enclosed in double quotation marks with no embedded blanks. IDEV may take one of the following values.

CRT	24 x 80 alphanumeric display (poor resolution)
HP	Hewlett - Packard X - Y Plotter
PTX	Printronix High - resolution line printer
SEL	Selenar Board (VT-100 with special hardware)
"4014"	Tektronix 4014 and 4014 emulators (4014 emulation software is avaliable for the Macintosh)
"4115"	Tektronix 4115

The standard display device is the Tektronix 4115B. Users on other systems must make sure that IDEV is set appropriately. The FIND and LOCATE commands are only supported on the 4115B.

The value of IPRO is set automatically by the program. It is increased on a PROCESS command, according to the last algorithm successfully completed. Thus, for example, if the PROCESS command successfully completed all the way through ALLOCATE, IPRO would be set to 600; while, if it exited after successfully completing ACCESS, IPRO would be set to 300. The value of IPRO may be decreased on an ADD, DELETE, CHANGE or COPY command. In this case, IPRO is either set to the smaller of its previous values or set to the value of the IAFT item in the Table Structure Table (TSTR) (See Section IV.1.1). Values for IAFT are as follows:

```
CRSHOW -- RECORD #    2    IDWORD=ASTR
          IAFT=          0

CRSHOW -- RECORD #    3    IDWORD=ALGP
          IAFT=          0

CRSHOW -- RECORD #    4    IDWORD=CMDL
          IAFT=        100

CRSHOW -- RECORD #    5    IDWORD=CURR
          IAFT=        600
```

```
CRSHOW -- RECORD #   6    IDWORD=DISP
           IAFT=        600

CRSHOW -- RECORD #   7    IDWORD=GEOM
           IAFT=          0

CRSHOW -- RECORD #   8    IDWORD=LLTR
           IAFT=        200

CRSHOW -- RECORD #   9    IDWORD=NODP
           IAFT=        250

CRSHOW -- RECORD #  10    IDWORD=PBOR
           IAFT=        600

CRSHOW -- RECORD #  11    IDWORD=ROZ
           IAFT=        600

CRSHOW -- RECORD #  12    IDWORD=SPED
           IAFT=        600

CRSHOW -- RECORD #  13    IDWORD=STCH
           IAFT=        100

CRSHOW -- RECORD #  14    IDWORD=STGB
           IAFT=        200

CRSHOW -- RECORD #  15    IDWORD=SUPM
           IAFT=        100

CRSHOW -- RECORD #  16    IDWORD=SUPP
           IAFT=        100

CRSHOW -- RECORD #  17    IDWORD=SWCH
           IAFT=        100

CRSHOW -- RECORD #  18    IDWORD=TG
           IAFT=        200

CRSHOW -- RECORD #  19    IDWORD=THRT
           IAFT=        100

CRSHOW -- RECORD #  20    IDWORD=TMDL
           IAFT=        100

CRSHOW -- RECORD #  21    IDWORD=VEHP
           IAFT=          0

CRSHOW -- RECORD #  22    IDWORD=WEAP
           IAFT=        400

CRSHOW -- RECORD #  23    IDWORD=WFZ
```

```
IAFT=         600
```

Thus for example, if the value of IPRO is 600, and the user changes the LLTR file, then IPRO would be reduced to 200. A HELP STATUS command (Section III.1) would show that the STATESPACE is still good, but the NODES, ACCESS, ARCS, ROUTES, and ALLOCATE arrays are bad.

An example of the relevant items in the CURR table is shown below.

```
CRSHOW -- RECORD #    2     IDWORD=CURR

          ID  =     CURR
          IAOP=            2
          IPRO=          600
          IDEV=     4115
          IDC =     85/11/22 16:43
          IDM =     85/12/18 15:23
```

IV.1.5 DISP: Display Table

The DISP table consists of three records of data which contain parameters necessary for writing to four different graphic display devices. The information in this table supports Lambert Conformal Projection plots. The information in this table is internal to the display algorithms. The user should never directly modify this table.

The structure of the DISP table is shown below. This table may be recreated by typing "SHOW DISP HELP".

DISPLAY TABLE STRUCTURE

NAME	TYPE	SIZE	LOC	TITLE
IDEV	CH04	1	1	PLOTTING DEVICE
LMIN	INT	1	2	MIN HORIZONTAL RASTER
MMIN	INT	1	3	MIN VERTICAL RASTER
LMAX	INT	1	4	MAX HORIZONTAL RASTER
MMAX	INT	1	5	MAX VERTICAL RASTER
XSCL	REAL	1	6	HORIZ RASTER / DEG LONG.
YSCL	REAL	1	7	VERT RASTER / DEG LAT.
XSUB	REAL	1	8	LONG AT HORIZ RASTER = 0
YSUB	REAL	1	9	LAT AT VERT RASTER = 0
XMIN	REAL	1	10	MIN LONG IN WINDOW (DEG)
YMIN	REAL	1	11	MIN LAT IN WINDOW (DEG)
XMAX	REAL	1	12	MAX LONG IN WINDOW (DEG)
YMAX	REAL	1	13	MAX LAT IN WINDOW (DEG)
IMIN	INT	1	14	MINIMUM I IN WINDOW
JMIN	INT	1	15	MINIMUM J IN WINDOW
IMAX	INT	1	16	MAXIMUM I IN WINDOW
JMAX	INT	1	17	MAXIMUM J IN WINDOW
XLB1	REAL	1	18	1ST LABELLED LONG. (DEG)
DXLB	REAL	1	19	DELTA LABELLED LONG(DEG)
NXLB	INT	1	20	NUMBER OF LABELLED LONGS
YLB1	REAL	1	21	1ST LABELLED LAT (DEG)
DYLB	REAL	1	22	DELTA LABELLED LAT (DEG)
NYLB	INT	1	23	NUMBER OF LABELLED LATS.
LAT1	REAL	1	24	1ST ZERO DISTORTION LAT
LAT2	REAL	1	25	2ND ZERO DISTORTION LAT
XCEN	REAL	1	26	CENTRAL LONGITUDE
RCON	REAL	1	27	DEG FR YMAX TO PROJ POLE
TSCL	REAL	1	28	ANGULAR SCALE (DEG/LONG)
LSCL	REAL	1	29	LAMBERT LON SCALE FACTOR
MSCL	REAL	1	30	LAMBERT LAT SCALE FACTOR

LCON	REAL	1	31	LAMBERT LON CONSTANT
MCON	REAL	1	32	LAMBERT LAT CONSTANT
DUM1	REAL	1	33	DUMMY NOT USED YET
DUM2	REAL	1	34	DUMMY NOT USED YET
DUM3	REAL	1	35	DUMMY NOT USED YET
DUM4	REAL	1	36	DUMMY NOT USED YET
DUM5	REAL	1	37	DUMMY NOT USED YET
IDC	TIME	1	38	RECORD CREATION DATE
IDM	TIME	1	39	RECORD MODIFICATION DATE

IV.1.6 GEOM: Geometry Table

The GEOM table consists of a single record of data. The GEOM table is created by the program when the GEOM command is issued. This is normally performed at program initialization and is "transparent" to the user, that is, the user sees only the product (the GEOM table) and neither directly initiates nor sees the process itself. The user should never attempt to ADD, DELETE, CHANGE, or COPY the GEOM table. Most of this data is based on the data in the ALGP table. The scenario geometry is modified by changing ALGP.

The structure of the Geometry Table is shown below. This table may be recreated by typing "SHOW GEOM HELP".

GEOM TABLE STRUCTURE

NAME	TYPE	SIZE	LOC	TITLE
ID	CH04	1	1	ID = GEOM
NI	INT	1	2	NUMBER OF LONGITUDES
NJ	INT	1	3	NUMBER OF LATITUDES
NK	INT	1	4	NUMBER OF AGLS
NL	INT	1	5	NUMBER OF DIRECTIONS
XMAX	REAL	1	6	MAXIMUM LONGITUDE
XMIN	REAL	1	7	MINIMUM LONGITUDE
YMAX	REAL	1	8	MAXIMUM LATITUDE
YMIN	REAL	1	9	MINIMUM LATITUDE
AL	REAL	5	10	STATESPACE ALTITUDES (M)
DX	REAL	3	15	STATESPACE DELTS (DEG,M)
IDEL	INT	8	18	DELTA I (LTH DIRECTION)
JDEL	INT	8	26	DELTA J (LTH DIRECTION)
XO	REAL	3	34	STATESPACE ORIGIN(DEG,M)
IDC	TIME	1	37	RECORD CREATION DATE
IDM	TIME	1	38	RECORD MODIFICATION DATE

The first item is the record ID and is always equal to GEOM. The next three items, NI, NJ, and NK give the number of statespace cells in the east, north and vertical direction. The number of cells is determined by the size of the statespace, the cell size, and the number of altitude levels specified in ALGP. XMIN, YMIN, XMAX, and YMAX are the southwest and northeast corners of the statespace respectively. AL contains the altitude levels. DX(1) and DX(2) contains the north and east statespace cell size in decimal degrees. DX(3) is not currently being used. IDEL and JDEL define the eight transition directions and are used by the dynamic programming algorithm. XO is again the southwest corner of the statespace.

IV.1.7 LLTR: Low Level Transit Route Table

The LLTR table defines the low level transit route (LLTR) network connecting the staging bases with the FEBA. This table must be constructed, or modified, by the user to model the transit route network in effect at the time the missions are to be flown. It contains one record for each LLTR node point. This record defines the ID, type and location of that node as well as its interconnections to other nodes. Records of this table may be referred to by their record number or the ID of the node as in the commands "SHOW LLTR 4" or "SHOW LLTR N008". Illustrated below is the description of the LLTR table structure which is generated by the FLAPS command "SHOW LLTR HELP".

NAME	TYPE	SIZE	LOC	TITLE
ID	CH08	1	1	ID OF TRANSIT ROUTE NODE
X	REAL	2	3	LONG-LAT OF LLTR NODE
CLNG	REAL	1	5	TRANSIT ROUTE CEILING
ITYP	INT	1	6	TRANSIT ROUTE TYPE
ICON	CH08	3	7	LLTR NODE CONNECTIONS
IDC	TIME	1	13	RECORD CREATION DATE
IDM	TIME	1	14	RECORD MODIFICATION DATE

The first item in each record is a unique ID for the LLTR node. This ID may be up to 8 alphanumeric characters long and the first character must be alpha. The second item (X) consists of the longitude and latitude (in that order) of the node, given in decimal degrees according to the convention: Longitude +East/-West; Latitude +North/-South. Item three (CLNG) is not presently used by the program. Item four (ITYP) is the node type: type 0 - inactive node, type 1 - active entry node, type 2 - active intermediate node, type 3 - active exit node. Item five (ICON) is a list of the other LLTR node IDs to which this node is connected; presently the length of this list may not

exceed 3. A connection is defined only for the direction from the staging base to the FEBA. Therefore, active exit points will have no connections and active entry points must have at least one connecting LLTR node. All LLTR nodes must be inside the scenario space, or else they will be ignored by the program. In addition, all LLTR exit points must be inside the statespace. This is because the dynamic programming algorithm (DPA) is used to generate routes from the LLTR exit points to the targets. The DPA can only be executed between two points if they are both inside the statespace.

IV.1.8 NODP: Node Parameter Table

The NODP table contains the number of nodes which are active in the specified scenario. NODP is an exception to the usual FLAPS convention that tables are defined by the user and arrays defined by the program - NODP consists of a single record (#2) whose items are computed by the FLAPS command "NODES". The contents of this table may be examined with the command "SHOW NODP 2" but NODP records should never be added, copied, deleted or changed by the user. The description of the structure of NODP illustrated below is produced by the command "SHOW NODP HELP".

NAME	TYPE	SIZE	LOC	TITLE
ID	CR04	1	1	ID = NODP
NSB	INT	1	2	NUMBER OF STAGING BASES
NTR	INT	1	3	NUMBER OF LLTR NODES
NTG	INT	1	4	NUMBER OF TARGETS
NTR1	INT	1	5	NBR OF LLTR ENTRY NODES
NTR2	INT	1	6	# OF LLTR INTERMED NODES
NTR3	INT	1	7	NBR OF LLTR EXIT NODES
IDC	TIME	1	8	RECORD CREATION DATE
IDM	TIME	1	9	RECORD MODIFICATION DATE

Item one of the record is the table ID - NODP. Items NSB, NTR and NTG are the numbers of staging bases, LLTR nodes and targets, respectively, determined to be active and within the geographical region of interest. For example, inactive LLTR nodes (ITYP=0), targets outside the statespace boundaries, and staging bases and LLTR nodes outside the scenario boundaries are not counted and are excluded from consideration in the mission planning problem. Items NTR1, NTR2 and NTR3 allocate the total in item NTR among the 3 LLTR node types: entry, intermediate and exit.

IV.1.9 PBOR: Political Border Table

The PBOR table contains a list of long/lat points that outline the political borders between countries in a scenario. The PBOR table is used to display the country borders on the Tektronix 4115. Each record can contain one or more borders between countries.

IV.1.9.1 PBOR Table Structure

The structure of the PBOR table is shown below. This table may be reproduced by typing "SHOW PBOR HELP".

PBOR TABLE STRUCTURE

NAME	TYPE	SIZE	LOC	TITLE
ID	CH08	1	1	ID OF POLITICAL BORDERS
NPTS	INT	1	3	NBR OF PBOR BOUNDARY PTS
XPB	REAL	200	4	LONG-LAT OF BNDRY POINTS
IDC	TIME	1	204	RECORD CREATION DATE
IDM	TIME	1	205	RECORD MODIFICATION DATE

The first item in the PBOR table is the political border ID. This ID may be up to eight characters long and must begin with an alpha character. This ID usally describes the countries around the borders being plotted. The second item (NPTS) is the number of longitude/latitude points in each record. One hundred points is the maximum, with each longitude/latitude coordinate counting as one point. The third item (XPB) is the political border points position expressed as decimal degress (longitude and latitude). The data points must be contiguous (all entered in either clockwise or counterclockwise direction).

IV.1.9.2 PBOR Table Usage

The current PBOR files contain all of the political borders for Western Europe within the current scenario space (July 85 delivery). The user will not need to add or change these files. If the scenario is increased or moved, the PBOR records will have to be updated. If new boundary points are desired, records may be added. The user could include roads, rivers or other cultural boundaries if data bases are available. The data may be displayed by using the BOUNDARY and MISSION options of the DISPLAY command.

An example of a PBOR record is shown below.

```
 CRSHOW -- RECORD #   5    IDWORD=EASGER

          ID  =    EASGER
          NPTS=         76
          XPB = 1.2150E+01 5.0317E+01 1.2217E+01 5.0317E+01
                1.2333E+01 5.0167E+01 1.2333E+01 5.0233E+01
                1.2500E+01 5.0400E+01 1.2833E+01 5.0467E+01
                1.2950E+01 5.0400E+01 1.3000E+01 5.0433E+01
                1.3050E+01 5.0517E+01 1.3167E+01 5.0517E+01
                1.3217E+01 5.0517E+01 1.3250E+01 5.0583E+01
                1.3300E+01 5.0567E+01 1.3417E+01 5.0633E+01
                1.3450E+01 5.0583E+01 1.3467E+01 5.0600E+01
                1.3500E+01 5.0633E+01 1.3517E+01 5.0717E+01
                1.3783E+01 5.0733E+01 1.3850E+01 5.0733E+01
                1.3883E+01 5.0750E+01 1.3900E+01 5.0800E+01
                1.4000E+01 5.0817E+01 1.4050E+01 5.0800E+01
                1.4083E+01 5.0800E+01 1.4217E+01 5.0867E+01
                1.4217E+01 5.0900E+01 1.4383E+01 5.0900E+01
                1.4400E+01 5.0933E+01 1.4300E+01 5.0967E+01
                1.4333E+01 5.0967E+01 1.4283E+01 5.0983E+01
                1.4267E+01 5.1000E+01 1.4300E+01 5.1050E+01
                1.4417E+01 5.1017E+01 1.4500E+01 5.1050E+01
                1.4500E+01 5.1017E+01 1.4583E+01 5.1000E+01
                1.4617E+01 5.0967E+01 1.4583E+01 5.0917E+01
                1.4650E+01 5.0933E+01 1.4617E+01 5.0867E+01
                1.4800E+01 5.0817E+01 1.4817E+01 5.0867E+01
                1.4967E+01 5.1000E+01 1.5000E+01 5.1167E+01
                1.5033E+01 5.1283E+01 1.5000E+01 5.1317E+01
                1.4983E+01 5.1400E+01 1.4967E+01 5.1467E+01
                1.4717E+01 5.1517E+01 1.4700E+01 5.1550E+01
                1.4733E+01 5.1617E+01 1.4717E+01 5.1667E+01
```

1.4667E+01	5.1733E+01	1.4667E+01	5.1800E+01
1.4633E+01	5.1800E+01	1.4583E+01	5.1833E+01
1.4700E+01	5.1917E+01	1.4717E+01	5.2000E+01
1.4767E+01	5.2067E+01	1.4683E+01	5.2100E+01
1.4683E+01	5.2133E+01	1.4700E+01	5.2167E+01
1.4700E+01	5.2233E+01	1.4600E+01	5.2267E+01
1.4533E+01	5.2383E+01	1.4550E+01	5.2433E+01
1.4617E+01	5.2500E+01	1.4600E+01	5.2533E+01
1.4633E+01	5.2583E+01	1.4217E+01	5.2817E+01
1.4133E+01	5.2833E+01	1.4167E+01	5.2867E+01
1.4133E+01	5.2967E+01	1.4250E+01	5.3000E+01
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

IDC = 85/11/22 16:43
IDM = 85/11/22 16:43

IV.1.10 ROZ: Restricted Operating Zone Table

The ROZ table is used to store the locations where the planner wishes to place restricted areas of flying. Each record contains one area of restricted operating zones.

IV.1.10.1 ROZ Table Structure

The structure of the ROZ table is shown below. This table may be reproduced by typing "SHOW ROZ HELP".

ROZ TABLE STRUCTURE

NAME	TYPE	SIZE	LOC	TITLE
ID	CH08	1	1	ID OF ROZ
NPTS	INT	1	3	NBR OF ROZ BOUNDARY PTS
X	REAL	20	4	LONG-LAT OF BNDRY POINTS
TON	REAL	1	24	TIME ON OF ROZ
TOFF	REAL	1	25	TIME OFF OF ROZ
IDC	TIME	1	26	RECORD CREATION DATE
IDM	TIME	1	27	RECORD MODIFICATION DATE

The first item in the ROZ table is the restricted operating zone ID. This ID may be up to eight characters long and must begin with a letter. This ID can refer to the area involved or anything else the user wishes. The second item (NPTS) is the number of boundary points of the area. There is a minimum of three boundary points (triangle shaped area) and a maximum of ten points (ten-sided polygonal area). The third item (X) contains the vertices of the restricted operating zone as longitude and latitude. Longitude and latitude are in decimal degrees. The vertices must be contiguous (all entered in either clockwise or counterclockwise order). The fourth item (TON) is the time of day the ROZ is on and the fifth item (TOFF) is the time of day the ROZ is off. At

this time TON and TOFF are not being used. TON and TOFF are expressed in decimal hours.

IV.1.10.2 ROZ Table Usage

The ROZ table is added by the user with the standard table ADD command. Records can be changed, deleted, or copied. The data may be displayed by using the RZ option in the DISPLAY command. At this time, ROZ's are only used for display purposes and will have no effect on the routes. It is assumed that the LLTR data is correct and no attempt is made to verify that ROZ's are in fact avoided by the current set of available LLTR's.

An example of a ROZ record is shown below.

```
CRSHOW -- RECORD #   2    IDWORD=T1ROZ1

        ID  =     T1ROZ1
        NPTS=          8
        X   = 8.5807E+00 5.1252E+01 8.4132E+00 5.1652E+01
              8.6016E+00 5.1998E+01 9.3551E+00 5.2211E+01
              1.0171E+01 5.2024E+01 1.0255E+01 5.1732E+01
              9.8575E+00 5.1452E+01 9.4807E+00 5.1292E+01
              0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
        TON = 0.0000E+00
        TOFF= 0.0000E+00
        IDC =     85/11/22 16:43
        IDM =     85/11/22 16:43
```

IV.1.11 SPED: Sortie Record Table

The SPED table contains routes (sorties) stored as a series of waypoints and a header. Each record of the SPED table contains one route. Records in the SPED table are created using the SELECT command. Refer to the description of the SELECT command in Section III.2.12 to see how and when SPED records may be created. Each SPED record is quite large relative to the other tables in FLAPS. This makes SPED records rather difficult to manipulate. Several features have been built into FLAPS to make using the SPED table as easy as possible.

Routes are stored in the SPED table to support three commands. First, the DISPLAY command reads SPED records in order to graphically display routes. Refer to the ROUT option in the DISPLAY command in Section III.2.9. Routes are also read out of the SPED file for threat exposure analysis. Refer to the ANALIZE command in Section III.1.12. Finally, routes stored in the SPED table may be printed out in a flight plan format. Refer to the PLAN option for the SHOW command in Section III.2.7 and the flight plan description in Section IV.2.16.

IV.1.11.1 Table Structure

The structure of the SPED table is shown below. This table can be recreated by typing "SHOW SPED HELP".

SPED TABLE STRUCTURE

NAME	TYPE	SIZE	LOC	TITLE
ID	CH12	1	1	SORTIE ID (USER CHOOSEN)
ISB	INT	1	4	STAGING BASE INDEX
ITG	INT	1	5	TARGET INDEX
PS	REAL	1	6	PROB OF SURVIVAL
PTH	REAL	1	7	PROB KILL DUE TO THREATS

DFLT	REAL	1	8	DISTANCE
TTOT	REAL	1	9	TAKE OFF TIME
TOT	REAL	1	10	TIME ON TARGET
NPT	INT	1	11	# OF COORDS IN PATH
COOR	REAL	720	12	T,X,Y,A,HEADING,NODE
IDC	TIME	1	732	RECORD CREATION DATE
IDM	TIME	1	733	RECORD MODIFICATION DATE

Each SPED record is exactly 733 words long. The record represents a total route from the staging base to the target and back to the staging base. At this time, a maximum of 50 records may be stored in the SPED table. As with every FLAPS table, the first record contains header information, so that a maximum of 49 routes may be stored.

The first item in each record must be a unique ID. The ID may be up to 12 characters long, the first character must be a letter. The second and third items in each SPED record are the indices of the sortie staging base (ISB) and target (ITG), respectively. These index numbers correspond to the NLIS array. The fourth item is the total route probability of survival (PS). The fifth is the probability of kill due to threats (PTH). The total probability of survival is the product of one minus the probability of kill due to threats and one minus a small probability of kill due to "air danger." The sixth item is the total route distance (DFLT). The seventh is the take off time (TTOT) in minutes. The eighth is the time on target (TOT) in minutes. The ninth item is the number of waypoints in the route (NPT).

Next, the actual coordinates of the waypoints are stored (COOR). There are six components of a waypoint. The first is the time in minutes at which the waypoint occurs, the second and third are the longitude and latitude both in decimal degrees, the fourth is the altitude (above ground level) in meters, the

fifth is heading from north in degrees, and the sixth is an integer index. The integer index corresponds to the NLIS array and will be nonzero if the waypoint is a staging base, target or LLTR node. Each SPED record may contain up to 120 waypoints. Routes with fewer waypoints will contain zeros after the last waypoint.

IV.1.11.2 SPED Table Usage

Records in the SPED table may be shown, added, deleted, changed or copied just like any other table. However, because of the length of each SPED table record, care must be taken when working with the SPED table. SPED records should only be added using the SELECT command. The user should feel free to delete SPED records if some records are no longer needed or if more room is needed. The user should never have to change items in a specific SPED record or copy SPED records. The user may wish to show items in a SPED record header, such as DFLT or PS. If this is the case, the user should specify the items he or she wishes to see. Showing an entire SPED record is not recommended because of the length of the COOR item. The SHOW PLAN command was created to print out SPED records in an easily interpreted form. SHOW PLAN should be used if the user wishes to see the actual route waypoints.

When creating a SPED record using SELECT, FLAPS will automatically determine an ID if the user wishes. The ID is determined as follows: The first four characters of the SPED ID are the first four characters of the name of the staging base at which the route originated, the fifth character is an underscore "_", the sixth through ninth characters are the first four characters of the

name of the target, the tenth character is an underscore, and the eleventh and twelfth characters are a sequence number between 01 and 09. For example, the first time a route from Ramstein AFB to target Caslav is put in the SPED table, the ID will be RAMS.CASL.01. If a second version of this route is put into the SPED table (say after suppression has been applied), then the ID will be RAMS.CASL.02. Of course the user can override this convention by inputing his own ID while executing SELECT.

Please note that the probability of survival and kill data is valid for the route at the time it was created only. If suppression is later applied or threats are added, the probability of survival data is not updated. The ANALIZE command computes probability of survival on the current statespace and should be used to check the impact of statespace changes on specific routes.

An example of a SPED record is shown below.

```
CRSHOW -- RECORD #    2     IDWORD=LAKEPANE01
           ID   =    LAKEPANE01
           ISB  =          2
           ITG  =        121
           PS   = 4.0261E-01
           PTH  = 5.9709E-01
           DFLT= 1.2088E+03
           TTOT= 0.0000E+00
           TOT  = 7.5091E+01
           NPT  =         35
           COOR= 0.0000E+00 5.8330E-01 5.2400E+01 6.0100E+01
                 1.2401E+02 0.0000E+00 4.0891E+01 7.6542E+00
                 4.9288E+01 6.0100E+01 1.0547E+02 0.0000E+00
                 4.3238E+01 8.1150E+00 4.9205E+01 6.0100E+01
                 9.7300E+01 0.0000E+00 4.7171E+01 8.9085E+00
                 4.9138E+01 6.0100E+01 8.5424E+01 0.0000E+00
                 4.9150E+01 9.3097E+00 4.9159E+01 6.0100E+01
                 9.2520E+01 0.0000E+00 5.2912E+01 1.0074E+01
                 4.9137E+01 6.0100E+01 5.2032E+01 0.0000E+00
                 5.5614E+01 1.0508E+01 4.9358E+01 6.0100E+01
                 8.4893E+01 0.0000E+00 5.9036E+01 1.1205E+01
                 4.9398E+01 6.0100E+01 5.3467E+01 0.0000E+00
                 6.3336E+01 1.1914E+01 4.9738E+01 6.0100E+01
```

4.7824E+01	0.0000E+00	6.6741E+01	1.2436E+01
5.0042E+01	6.0100E+01	8.4796E+01	0.0000E+00
7.0196E+01	1.3149E+01	5.0083E+01	6.0100E+01
6.0126E+01	0.0000E+00	7.2716E+01	1.3602E+01
5.0250E+01	6.0100E+01	4.4801E+01	0.0000E+00
7.3599E+01	1.3732E+01	5.0333E+01	6.0100E+01
0.0000E+00	0.0000E+00	7.3912E+01	1.3732E+01
5.0375E+01	6.0100E+01	9.0000E+01	0.0000E+00
7.4534E+01	1.3862E+01	5.0375E+01	6.0100E+01
1.4189E+02	0.0000E+00	7.5091E+01	1.3933E+01
5.0317E+01	6.0100E+01	1.2402E+02	0.0000E+00
7.5427E+01	1.3991E+01	5.0292E+01	6.0100E+01
4.4799E+01	0.0000E+00	7.5869E+01	1.4056E+01
5.0333E+01	6.0100E+01	3.1523E+02	0.0000E+00
7.6310E+01	1.3991E+01	5.0375E+01	6.0100E+01
2.7000E+02	0.0000E+00	7.7554E+01	1.3732E+01
5.0375E+01	6.0100E+01	1.8000E+02	0.0000E+00
7.7867E+01	1.3732E+01	5.0333E+01	6.0100E+01
2.2485E+02	0.0000E+00	7.8750E+01	1.3602E+01
5.0250E+01	6.0100E+01	2.4021E+02	0.0000E+00
8.1270E+01	1.3149E+01	5.0083E+01	6.0100E+01
2.6287E+02	0.0000E+00	8.3792E+01	1.2630E+01
5.0042E+01	6.0100E+01	2.2500E+02	0.0000E+00
8.4235E+01	1.2565E+01	5.0000E+01	6.0100E+01
2.7000E+02	0.0000E+00	8.5175E+01	1.2371E+01
5.0000E+01	6.0100E+01	2.2843E+02	0.0000E+00
8.8137E+01	1.1914E+01	4.9738E+01	6.0100E+01
2.3366E+02	0.0000E+00	9.2437E+01	1.1205E+01
4.9398E+01	6.0100E+01	2.6490E+02	0.0000E+00
9.5859E+01	1.0508E+01	4.9358E+01	6.0100E+01
2.3216E+02	0.0000E+00	9.8562E+01	1.0074E+01
4.9137E+01	6.0100E+01	2.7252E+02	0.0000E+00
1.0232E+02	9.3097E+00	4.9159E+01	6.0100E+01
2.6543E+02	0.0000E+00	1.0430E+02	8.9085E+00
4.9138E+01	6.0100E+01	2.7731E+02	0.0000E+00
1.0824E+02	8.1150E+00	4.9205E+01	6.0100E+01
2.8549E+02	0.0000E+00	1.1058E+02	7.6542E+00
4.9288E+01	6.0100E+01	3.0580E+02	0.0000E+00
1.5147E+02	5.8330E-01	5.2400E+01	6.0100E+01
3.0580E+02	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
		.	
		.	
		.	
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

IDC = 85/12/18 15:23
IDM = 85/12/18 15:23

IV.1.12 STCH: Stochastic Threat Model Table

The STCH table is used for those threats that exhibit one or more of the following features. The exact location of the threat is not known. The threat is a mobile threat whose location varies with time. The threat is a group of threats that are spread out over an area (such as tanks along a road or an army division). This table contains the necessary information to describe the area that a stochastic threat can cover without terrain masking. The generic threat information for each threat is obtained from the threat model table (TMDL).

IV.1.12.1 STCH Table Structure

The structure of the STCH table is shown below. This table may be recreated by typing "SHOW STCH HELP".

STCH TABLE STRUCTURE

NAME	TYPE	SIZE	LOC	TITLE
ID	CH04	1	1	THREAT ID
ITYP	CH08	1	2	THREAT TYPE NAME
XSC	REAL	3	4	THREAT LON,LAT, and ALT
EXNT	REAL	1	7	EXPECTED # OF THREATS
PEX	REAL	1	8	PROB THREAT EXISTS
RUNC	REAL	1	9	RADIUS OF UNCERTAINTY
NBPS	INT	1	10	# OF PTS ON STCH BORDER
XPBS	REAL	100	11	LON & LAT OF NTH POINT
FGRD	REAL	1	111	RATIO OF INT/GEO GRID
IDC	TIME	1	112	RECORD CREATION DATE
IDM	TIME	1	113	RECORD MODIFICATION DATE

The first item in the table is the stochastic threat ID. This ID is four characters long, with the first character being an alpha. The second item (ITYP) is the generic threat type name. This name can be up to eight characters long with the first character being an alpha. The threat type provides a pointer into the threat model table. The third item (XSC) is an array with three elements that gives the threat longitude, latitude, and altitude. This item is used when the threat is contained at one location with a radius of uncertainty. In this case, the variables containing the number of boundary points and the boundary point locations are ignored when calculating the stochastic area. The fourth item (EXNT) gives the expected number of threats to be found in the stochastic area. The fifth item (PEX) gives the probability of existence for this number of threats in the stochastic area. The sixth item (RUNC) gives the radius of uncertainty for the location of this threat. The seventh item (NBPS) gives the number of points that describe the boundary of the stochastic area for this threat. A stochastic area can be described by up to 50 points. The eighth item (XPBS) is an array containing the longitude and latitude for each point that describes the boundary of the stochastic area. It is used when the number of boundary points is greater than one. Then the variables containing the threat location and radius of uncertainty are ignored. The boundary points must be the vertices of a convex polygon. They must also be entered contiguously (either all clockwise, or all counterclockwise). The ninth item (FGRD) is the ratio of the integration grid size to the statespace grid size. An appropriate value to use for this variable is 1.0.

IV:1.12.2 STCH Table Usage

The STCH table is used when a threat is a mobile threat, an area threat, or there is poor information as to its exact location. In the cases where the threat is a mobile or area threat, a convex polygonal model is used to describe the threat boundaries. When the threat is a point with a radius of uncertainty, a circular model is used to describe the threat boundaries. Terrain masking is not used when modeling stochastic threats.

The current version of FLAPS does not support automatic threat suppression nor threat exposure analysis for stochastic threats. In other words, if the user has stochastic threats in his statespace and he applies suppression using the SUPRESS command, then the stochastic threat will not be suppressed. Similarly, if threat exposure is calculated for a route using the ANALYZE command, the time in and time out of the stochastic threats will not be reported. However, the leg-by-leg probability of survival report will be correct.

IV.1.13 STGB: Staging Base Table

The STGB table defines the locations and resources of the staging bases from which missions are to be flown. It contains one record for each staging base and must be constructed by the user to define the collection of staging bases of interest to his mission planning problem. These records may be referred to by their record number or by the staging base ID as in the commands "DELE STGB 5" or "SHOW STGB RAMSTEIN". Illustrated below is a description of the structure of the STGB table produced by the command "SHOW STGB HELP".

THE STAGING BASE (STGB) TABLE

NAME	TYPE	SIZE	LOC	TITLE
ID	CH08	1	1	ID OF STAGING BASE
X	REAL	2	3	LONG-LAT OF STAGING BASE
ITYP	CH04	1	5	TYPE OF AIRCRAFT AT BASE
NACR	INT	1	6	NUMBER OF AIRCRAFT
NWEP	INT	10	7	NUMBER OF WEAPONS
IDC	TIME	1	17	RECORD CREATION DATE
IDM	TIME	1	18	RECORD MODIFICATION DATE

The first item in each record is a unique alphanumeric ID for the staging base. This ID may be up to 8 characters long and the first character must be alpha. Item two (X) is the location of the staging base given as longitude, latitude (in that order) in decimal degrees according to the sign convention: Longitude +East/-West, Latitude +North/-South. Item three (ITYP) defines the type of aircraft assumed to be present at the staging base. This item may be up to 4 alphanumeric characters long and must agree with the aircraft ID of the record in the vehicle parameters table VEHP which describes this aircraft. Item four (NACR) is the number of aircraft available at the staging base. This

number is used by the allocation algorithm to insure that the proposed allocation of aircraft to targets is consistent with the aircraft resources. Item five (NWEP) is a list of the number of weapons of each type available at the staging base. The order of this list must be consistent with the order used in the items ISCL (table VEHP), FCIN (table VEHP), PDWP (table WEAP) and NAME (table WEAP). The present version of the FLAPS allocation algorithm does not perform a detailed accounting of numbers of weapons allocated - it simply checks that a non-zero number of the selected weapon type is available at the selected staging base.

IV.1.14 SUPM: Suppressor Model Table

The SUPM table contains data about the generic capabilities of the three types of threat suppressors modeled in FLAPS. Each SUPM record corresponds to a type of suppressor: EF-111, Compass Call, or Wild Weasel. For each type of suppressor, the SUPM table describes how much of an effect individual suppressors will have on the nearby threats. The locations of the individual suppressors are contained in the suppressor position (SUPP) table.

IV.1.14.1 SUPM Table Stucture

The structure of the SUPM table is shown below. This table may be recreated by typing "SHOW SUPM HELP".

SUPM TABLE STRUCTURE

NAME	TYPE	SIZE	LOC	TITLE
ID	CH08	1	1	SUPP MODEL IDENTIFIER
RAD	REAL	1	3	MAX RADIUS OF THE SUPPRE
ICAP	INT	1	4	SUPP CAPACITY
TYPE	REAL	25	5	LIST THRT TYPE EFFECTIVE
DEGR	REAL	25	30	DEGRADE THRT CAPACITY
IDC	TIME	1	55	DATE SUPP MODEL CREATED
IDM	TIME	1	56	DATE SUPP MODEL MODIFIED

The first item in the table is the suppressor model ID. This ID may be up to eight characters long. The first character should be an alpha. The second item is the suppressor radius (RAD) in nautical miles. This is the radius over which the suppressor will be effective. The third item is the suppressor capacity (ICAP). This is the number of threats that this type of suppressor can be effective against, at one time. The fourth item is a list of the threat types (TYPE) that this type of suppressor is effective against. Each threat type in this list must correspond to a threat model ID in the TMDL table. A maximum of 25 threat models may be listed. The fifth item is a list containing the threat model degrade factors (DEGR). This list must correspond to the list of threat types in TYPE. Each degrade must be a real number between 0.0 and 1.0.

IV.1.14.2 SUPM Table Usage

The SUPM table is much like the threat model table TMDL. Each one contains generic information about a system. A threat system, a SAM for example, in the case of TMDL; and an EW or hard kill suppression system in the case of SUPM. Data about the deployments of actual threats and suppression aircraft is contained in the threat table (THRT) and the suppressor position table (SUPP) respectively.

The user should be aware of several things when creating records in the SUPM table. Currently, the above ground level altitude of the suppressor is not being used in determing the suppressor radius of coverage. For planning purposes, the model will use the radius RAD, no matter how high or low each individual suppressor actually flies.

It is unrealistic to expect a single Wild Weasel to clear out a large number of SAMS. The capacity of the Wild Weasel is ultimately limited by the number of missiles it can carry. For this reason, a capacity factor has been included in the SUPM table. If the number of threats within the radius of coverage of a suppressor exceeds its capacity, then the suppressor effectiveness is downgraded by a factor equal to the the capacity of the suppressor divided by the number of threats within its coverage. For example, if ICAP=6 and DEGR=0.5, then as long as the number of threats within the radius of coverage is six or less, then each threat will be degraded by a factor of 0.5. However, if 10 threats were within the radius then each of them would be degraded by the factor 6/10 * 0.5 = 0.3. Only threat types matching the SUPM TYPE list are included in the calculation. If the user does not want to downgrade suppressor effectiveness in this way, he can set the suppressor capacity to a large number (like 1000000).

Degrades are applied to the threats in the following way. If a threat site (XTH in THRT) falls within the radius of coverage of a suppressor, and if the threat type is in the SUPM TYPE list, then a degrade is calculated. Nominally, the degrade will be the appropriate number in DEGR. The degrade number in DEGR corresponds to the position of the threat type in the TYPE list. If the suppressor capacity is not exceeded, this will be the degrade

contribution from this suppressor. If other suppressors are present, their degrade contributions are calculated in the same way. Finally, all of the contributions are factored in together and the threat's lethality will be degraded in the statespace (the SUPPRESS command). Each degrade is treated like an independent "probability of shutting the threat down." The effect of more than one suppressor on the same threat is multiplicative. If the capacity of one of the suppressors is exceeded, then the degrade contribution from that suppressor on each threat is downgraded as described above. FLAPS will warn the user of this during the SUPP command.

Finally, it is important that the degrades in DEGR be between 0.0 and 1.0. Negative degrades or degrades greater than 1.0 (100%) will produce errors in the statespace.

IV.1.15 SUPP: Suppressor Position Table

The SUPP table is used to store the locations where the planner wishes to place his available suppression assets. Each record in the suppressor position table will contain the position of one suppression asset.

IV.1.15.1 SUPP Table Structure

The structure of the SUPP table is shown below. This table may be reproduced by typing "SHOW SUPP HELP".

SUPP TABLE STRUCTURE

NAME	TYPE	SIZE	LOC	TITLE
ID	CH08	1	1	SUPPRESSOR IDENTIFIER
TYPE	CH08	1	3	SUPPRESSOR TYPE
XSU	REAL	3	5	LONG,LAT,TERR CLEAR ALT
IDC	TIME	1	8	DATE SUPP REC CREATED
IDM	TIME	1	9	DATE MODIFICATION

The first item in the SUPP table is the suppressor ID. This ID may be up to eight characters long and must begin with an alpha character. This ID need not refer to the type of suppressor that is being used. The second item (TYPE) is the suppressor type. This is an ID up to eight characters long and must match a suppressor model ID in the SUPM table. The third item (XSU) is the suppressor position as longitude, latitude, and altitude above ground level. Longitude and latitude are in decimal degrees; altitude is in meters.

IV.1.15.2 SUPP Table Usage

The SUPP table may be added to or changed by the user with the standard table ADD and CHANGE commands, however the user will usually prefer to create SUPP records graphically. This can be done on a Tektronix 4115B graphics display terminal using the LOCATE command. These records must be deleted in the usual way if the data is no longer appropriate. The data may be displayed using the SUPPRESSOR option of the DISPLAY command. A suppressor will not be effective against any threats if it has been placed in a poor location. Only threats whose centers are within the radius of coverage of a suppressor are affected. If the user does not see any effect after applying suppression, he should check the suppressor positions and the suppressor model. If the degrades are very small or if the suppressor capacity is exceeded, little effect will be seen.

IV.1.16 SWCH: Software Switch Table

The SWCH table contains a number of "software switches" which control the way in which the program executes. Most of these switches are not being used in the current version of FLAPS and are only included to provide growth potential for the future. As the capabitlity of the models in FLAPS expand, these switches will become useful. That is why the switch table has been maintained. It should never be necessary for the normal user to modify the SWCH table. The table will be write protected during normal execution. The normal user may skip this section.

There are only two records in the SWCH table. The first is a header record and the second is a record containing the actual data.

IV.1.16.1 SWCH Table Structure

The structure of the SWCH table is described below. This table can be recreated by typing "SHOW SWCH HELP".

SWCH TABLE STRUCTURE

NAME	TYPE	SIZE	LOC	TITLE
ID	CH04	1	1	ID
IAOP	INT	1	2	ALTITUDE OPTIMIZATION
IARP	INT	1	3	ARRAY PROCESSOR:1ON,0OFF
IBYT	INT	1	4	BYTE PACKED TERRAIN
ICLB	INT	1	5	CLOBBER
ICVB	INT	1	6	CL MODEL:0=BERMAN,1=GD
IDCN	INT	1	7	DECONFLICTION
IDUL	INT	1	8	DUAL CONTROL:0=Y,1,2=NO

IEND	INT	1	9	END POINTS OF ARCS
IFES	INT	1	10	INFEASIBLE TRANSITIONS
IGDS	INT	1	11	GD RUN
IGLD	INT	1	12	G LOAD:0=NO,1=YES
IMSK	INT	1	13	MASKING (- = GD APPROX)
IPCS	INT	1	14	CONST PROB OF CLOBBER
IREQ	INT	1	15	REQUANTIZATION
IRST	INT	1	16	RESTART ARCS
JRST	INT	1	17	RESTART TARCS
IRUF	INT	1	18	ROUGHNESS FILE
ISPD	INT	1	19	WRITE SPED FILE:YES R NO
ISRD	INT	1	20	LOOK AT ALL STATE SPACE
ITAV	INT	1	21	TARGET AVOID
ISHK	INT	1	22	SHRINK ACCESS BOX
ICAV	INT	1	23	LABEL DISPLAYS (SECRET)
IDM1	INT	1	24	DUMMY NOT USED YET
IDM2	INT	1	25	DUMMY NOT USED YET
IDM3	INT	1	26	DUMMY NOT USED YET
IDC	TIME	1	27	RECORD CREATION DATE
IDM	TIME	1	28	RECORD MODIFICATION DATE

The first item in the table is the ID which is always set to "SWCH". The IAOP, ICLB, ICVB, IFES, IGLD, IPCS, and IRUF switches all relate to three dimensional route planning and probability of clobber modeling. This capability is not yet available in FLAPS and these switches are not currently used. The IARP switch refers to a special hardware configuration which is currently not available, so this switch is not being used. The IBYT switch refers to the level of terrain data subsampling that is desired when reading the terrain data from the byte packed terrain data file, BYTE. This switch must be set to 1 in this version of FLAPS (no subsampling). The IDCN switch is for automated deconfliction of routes and is not now being used. The IDUL (dual control) switch will have a small effect upon the route generation algorithm. A setting of 0 is appropriate; a setting of 1 is also permissible. The IEND switch controls the way the route data is stored. A setting of 1 is appropriate for this version of FLAPS. The IGDS switch refers to certain constraints on routes near the target area and is not now being used. The IMSK svch refers to the

level of detail desired in the terrain masking algorithm. A setting of 2 is appropriate for this version of FLAPS. The requantization and restart switches IREQ, IRST, and JRST are not being used at this time. The ISPD switch refers to the SPED file and is not being used. The ISRD controls the way the statespace is read into the computer's core memory from disk. A setting of 0 is appropriate for this version of FLAPS. The target avoidance switch ITAV is not now being used. The shrink switch ISHK controls the way the "accessible nodes box" (NBOX) is constucted. A setting of 0 is appropriate for this version of FLAPS. The ICAV switch controls the labeling of the graphic displays and is not now being used. IDM1, IDM2, and IDM3 are dummy variables which are not now being used.

The following is a list of the current switch settings. This is what the user should see if he types "SHOW SWCH 2".

```
CRSHOW -- RECORD #   2    IDWORD=SWCH
         ID  =    SWCH
         IAOP=         0
         IARP=         0
         IBYT=         1
         ICLB=         0
         ICVB=         0
         IDCN=         0
         IDUL=         0
         IEND=         1
         IFES=         0
         IGDS=         0
         IGLD=         0
         IMSK=         2
         IPCS=         0
         IREQ=         0
         IRST=         0
         JRST=         0
         IRUF=         0
         ISPD=         0
         ISRD=         0
         ITAV=         0
         ISHK=         0
```

```
ICAV=          0
IDM1=          0
IDM2=          0
IDM3=          0
IDC =     85/11/22 16:43
IDM =     85/11/22 16:43
```


71

IV.1.17 TG: Target Table

The TG table defines the IDs, locations, types, priorities, hardnesses, and desired damage levels of all targets of interest in the mission planning problem. This table must be constructed by the user and consists of one record for each target up to a maximum of 49. These records may be referenced by their record number or by the threat ID as in "SHOW TG 12" or "DELE TG MILOVICE". The description of the target table shown below is produced by the command "SHOW TG HELP".

TARGET TABLE STRUCTURE

NAME	TYPE	SIZE	LOC	TITLE
ID	CH08	1	1	TARGET ID
XTG	REAL	2	3	LONG-LAT OF TARGET
CLAS	CH04	1	5	CLASSIFICATION OF TARGET
IPRI	INT	1	6	TARGET PRIORITY
ITYP	INT	1	7	TYPE OF TARGET
PDMN	REAL	1	8	MIN PROB DAMAG THRES TAR
IDC	TIME	1	9	RECORD CREATION DATE
IDM	TIME	1	10	RECORD MODIFICATION DATE

The first item of each record is a unique alphanumeric ID for that target. It may be up to 8 characters long and the first character must be alpha. Item two (XTG) is the target location given as longitude, latitude (in that order) in decimal degrees according to the sign convention: Longitude +East/-West, Latitude +North/-South. Item three (CLAS) is a 4 character target class descriptor not presently used by the program. Item four (IPRI) is the integer valued priority assigned to the target.This item controls the order in which aircraft and weapons are allocatedto targets. Thus a low value for this item indicates a high priority target. Item five (ITYP) is the target type

which must be a positive integer between 1 and 25. This item is used as an index to determine the targets vulnerability to the different weapon types. Therefore the value of this item must be consistent with the order of the values in the item PDWP (in the weapons table WEAP) which defines weapons effectiveness. Item six (PDMN) is the minimum probability of damage desired for the target and so its value must be a real number between 0 and 1. The allocation algorithm examines the single shot weapon effectiveness in item PDWP (in the table WEAP) and the aircraft weapon carrying capacity in item ISCL (in the vehicle parameters table VEHP) to determine how many aircraft and weapons are required to achieve this desired probability of damage. Thus, more aircraft (up to 10) will be allocated to this target as the value of the PDMN item approaches 1.0. Conversely, fewer aircraft (down to 2) will be allocated as its value approaches 0.

IV.1.18 THRT: Threat Location Table

The THRT table contains the necessary information to describe the location of fixed threats. These threats will have terrain masking applied to them before being included in the statespace.

IV.1.18.1 THRT Table Structure

The structure of the THRT table is shown below. This table may be recreated by typing "SHOW THRT HELP".

THRT TABLE STRUCTURE

NAME	TYPE	SIZE	LOC	TITLE
ID	CH04	1	1	THREAT ID
ITYP	CH08	1	2	THREAT TYPE
XTH	REAL	3	4	GEOD LON,LAT,ELE OF DEF
PEX	REAL	1	7	PROBABILITY THREAT EXISTS
IDC	TIME	1	8	RECORD CREATION DATE
IDM	TIME	1	9	RECORD MODIFICATION DATE

The first item of this table is a threat ID. This ID can be up to four characters long with the first character being an alpha. The second item (ITYP) is a threat type name. This name can be up to eight characters long with the first character being an alpha. The threat type provides a pointer into the threat model table (TMDL) to get the generic information about this threat. The third item (XTH) is a three element array containing the threat location in longitude, latitude, and altitude. The fourth item (PEX) is a probability of

existence for this threat.

IV.1.18.2 THRT Table Usage

The THRT table is used by the modules that do terrain masking, adding and deleting threats from the statespace, threat suppression, and route analysis. The longitude and latitude is entered as decimal degrees with east longitude and north latitude being positive. Altitude is entered as decimal meters. The probability of existence is entered as a decimal from 0.0 to 1.0 .

IV.1.19 TMDL: Threat Model Table

The TMDL table contains the generic information for each type of threat that is used in the statespace. The model contains a threat exposure template that is symmetric around the downrange axis. This model assumes that the threat template is a vertical cylinder, and contains only one set of danger (negative log probability of survival) values for all altitudes.

IV.1.19.1 TMDL Table Structure

The structure of the TMDL table is shown below. This table may be recreated by typing "SHOW TMDL HELP".

TMDL TABLE STRUCTURE

NAME	TYPE	SIZE	LOC	TITLE
ID	CH05	1	1	SPECIFIC THREAT MODEL ID
RMAX	REAL	1	3	MAXIMUM RANGE OF THREAT
DMIN	REAL	1	4	MIN LOG-PROB INSIDE RMAX
NDRG	INT	1	5	NUMBER OF DOWNRANGE PTS
NCRG	INT	1	6	NUMBER OF CROSSRANGE PTS
DRG1	REAL	1	7	1ST DOWNRANGE PT (NM)
CRG1	REAL	1	8	1ST CROSSRANGE PT (NM)
DDRG	REAL	1	9	DELTA DOWNRANGE (NM)
DCRG	REAL	1	10	DELTA CROSSRANGE (NM)
PLOG	REAL	200	11	PLOG AT NTH CROSSRANGE
DUM1	REAL	1	211	DUMMY NOT USED YET
DUM2	REAL	1	212	DUMMY NOT USED YET
DUM3	REAL	1	213	DUMMY NOT USED YET
DUM4	REAL	1	214	DUMMY NOT USED YET
DUM5	REAL	1	215	DUMMY NOT USED YET
HIGH	REAL	1	216	MAX THREAT HEIGHT
FLOR	REAL	1	217	MIN THREAT DEPRES. HT
IDC	TIME	1	218	RECORD CREATION DATE
IDM	TIME	1	219	RECORD MODIFICATION DATE

The first item in the threat model table is a generic threat ID. This ID contains up to five characters and must begin with a letter. The second item (RMAX) is the maximum lethal range of the threat in decimal nautical miles. The third item (DMIN) is the minimum danger level that will be applied to the statespace within the threat's maximum radius. The user may set DMIN to a small danger level. This will tend to force the routes to fly around the threat's maximum radius, rather than to just avoid the threat's unmasked coverage. That is, even if a cell is terrain masked from a threat, a small amount of danger will be added to the statespace at that cell. DMIN is normally set to 0.0 in scenarios with dense threat coverage. A value of zero is appropriate in the european theatre. The fourth item (NDRG) is the integer number of downrange points up to a maximum of 20 points. If the number of downrange points is set to one, the statespace algorithm uses the first value in the log probability of

danger array to create a cookie cutter type threat template at all unmasked points. The fifth item (NCRG) is the integer number of crossrange points up to a maximum of 10 points. The sixth item (DRG1) is the range to the first downrange point in nautical miles. The seventh item (CRG1) is the range to the first crossrange point in nautical miles. The eighth item (DDRG) is the range difference between downrange points in nautical miles. The ninth item (DCRG) is the range difference between crossrange points in nautical miles. The tenth item (PLOG) is an array that contains the danger template, which is defined as the negative log of probability of survival per second. The negative log of probability of survival per second is also refered to as the "danger rate" or the level of "danger." Each set of 20 elements in this array contains all the downrange values for one crossrange setting. The tenth through fourteenth items are dummy items that are not used at this time. The fifteenth item (HIGH) is the maximum lethal height of the threat in meters. The sixteenth item (FLOR) is the minimum lethal height of the threat in meters, to take into account the minimum depression angle on some threats.

An example of a record from the threat model table is shown below.

```
CRSHOW -- RECORD #    6    IDWORD=SA-6

          ID   =    SA-6
          RMAX= 1.8500E+01
          DMIN= 0.0000E+00
          NDRG=         11
          NCRG=          6
          DRG1=-1.8500E+01
          CRG1= 0.0000E+00
          DDRG= 3.7000E+00
          DCRG= 3.7000E+00
          PLOG= 0.0000E+00 1.0000E-03 2.0000E-03 3.0000E-03
                3.5000E-03 2.0000E-03 1.0000E-03 0.0000E+00
                0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
                0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
                0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
```

```
0.0000E+00 1.5000E-03 3.0000E-03 5.0000E-03
6.0000E-03 4.0000E-03 1.0000E-03 5.0000E-04
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 1.0000E-03 2.5000E-03 5.0000E-03
2.5000E-03 1.0000E-03 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 5.0000E-04 1.5000E-03 3.0000E-03
2.0000E-03 5.0000E-04 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 1.5000E-03
1.0000E-03 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
                    .
                    .
                    .
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
DUM1= 0.0000E+00
DUM2= 0.0000E+00
DUM3= 0.0000E+00
DUM4= 0.0000E+00
DUM5= 0.0000E+00
HIGH= 1.5240E+04
FLOR= 0.0000E+00
IDC =    85/11/22 16:43
IDM =    85/11/22 16:43
```

IV.1.19.2 TMDL Table Usage

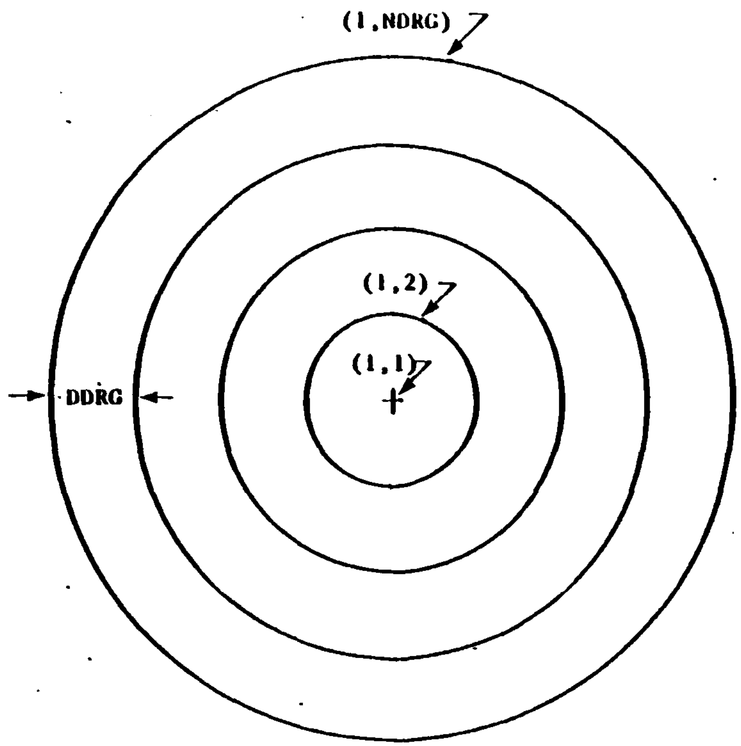
These threat templates are combined with the terrain masked templates for each threat to create a danger statespace.

Normally, threat templates will be delivered with the software. However, the user may create his or her own threat templates. The user has several options for creating threat templates. The user may create "non-symmetric" templates where the danger level varies as a function of cross-range and down-range distance. The template shown above is an example of a "non-symmetric" template. The user may also create two simpler types of templates. These are the "circularly-symmetric" and "cookie-cutter" templates.

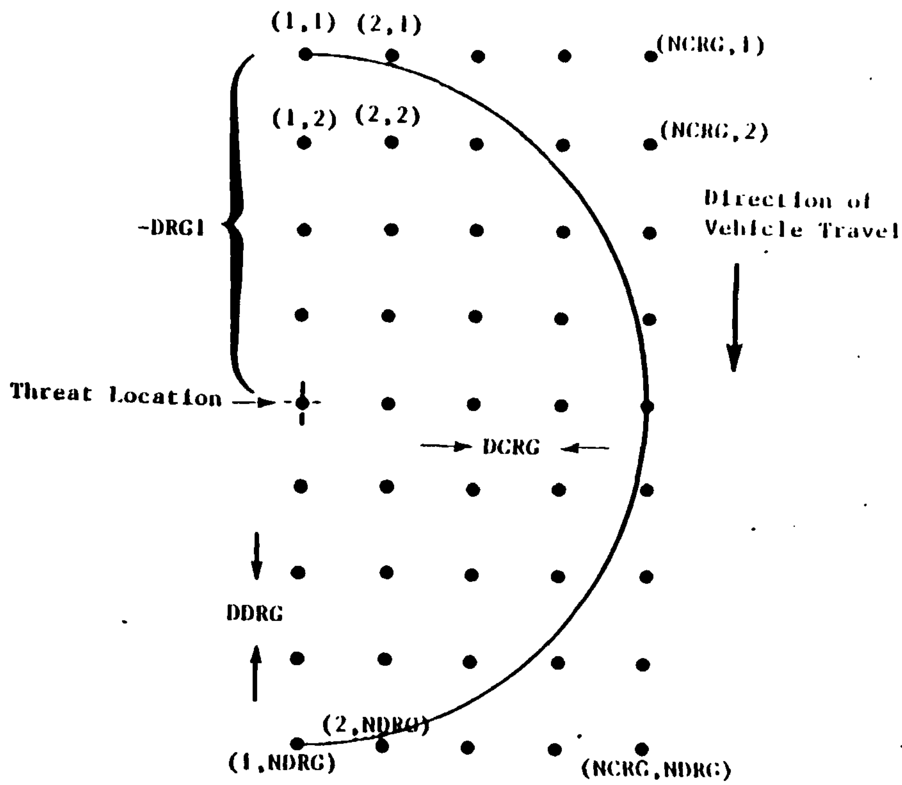
For a non-symmetric threat, the number of cross-range points (NCRG) must be greater than 1, and the first cross-range value (CRG1) should be 0.0 nm. Then PLOG(j) (j < 21) is the danger at the j-th downrange and first crossrange point. PLOG(j) (20 < j < 41) is the danger at the (j-20)-th downrange point, and the second crossrange point. Refer to Figure IV-1.

For a circularly symmetric threat, the number of cross-range points (NCRG) must be set to 1, and the first radial (downrange) value (DRG1) to 0.0 nm. Then PLOG(1), PLOG(21), PLOG(41), ..., PLOG(j*20 + 1), .., PLOG(181) gives the danger level at the first, second, ..., j-th, radial distance. Refer to Figure IV-1.

For a cookie-cutter threat, the danger level is the same for all points inside the threats lethal radius. This feature is accomplished by setting the item NDRG to 1, and setting PLOG(1) to the danger rate. No other PLOG values are looked at by the program.



Circularly Symmetric Threat



Non Symmetric Threat

Figure IV-1

IV.1.20 VEHP: Vehicle Parameters Table

The VEHP table defines the ID, dynamics, fuel characteristics, weapon carrying capacity and radar profile for all the aircraft of interest in the mission planning problem. This table must be constructed by the user and consists of one record for each aircraft type. Records may be referenced by their record number or by the aircraft ID as in "DELE VEHP 3" or "SHOW VEHP F-16". The description of the VEHP table shown below is produced by the command "SHOW VEHP HELP".

VEHICLE PARAMETERS TABLE STRUCTURE

NAME	TYPE	SIZE	LOC	TITLE
ID	CH04	1	1	AIRCRAFT ID
VNOM	REAL	1	2	AIRCRAFT VELOCITY (NM/S)
CLM	REAL	1	3	MAX CLIMB RATE (M/S)
DIV	REAL	1	4	MAX DIVE RATE (M/S)
FCAP	REAL	2	5	FUEL CAPACITY (POUNDS)
FCEG	REAL	2	7	FUEL CONSUMP. (EGRESS)
FCIN	REAL	20	9	FUEL CONSUMP. (INGRESS)
NMFC	INT	1	29	NUMBER OF FUEL CONFIGS.
ISCL	INT	20	30	STD. CONFIGURATION LOAD
RCS	REAL	8	50	RADAR CROSS SECTIONS
TRAD	REAL	1	58	MAX TURN RADIUS (M)
TYP	CH04	1	59	AIRCRAFT TYPE
IDC	TIME	1	60	RECORD CREATION DATE
IDM	TIME	1	61	RECORD MODIFICATION DATE

Item one of each record is a unique alphanumeric ID for the aircraft type. It may be up to 4 characters long and the first character must be a letter. Item two (VNOM) is the nominal aircraft velocity in units of nautical miles per second. This item is used in the computation of flying time and threat exposure along a route. Items three and four (CLM and DIV) are not

presently used by the program. Item five (FCAP) is a list of real numbers defining the aircraft fuel capacity in pounds as a function of the fuel configuration selected. Item six (FCEG) is a list of real numbers defining the aircraft fuel consumption rate during egress in pounds per second as a function of fuel configuration selected. Item seven (FCIN) is a list of real numbers defining the aircraft fuel consumption rates in pounds per second during ingress as a function of fuel configuration selected and weapon type being carried. This array is dimensioned (10,2). Item eight (NMFC) is the allowable number of fuel configurations - presently set at 2. Item nine (ISCL) is a list of integers defining the weapon carrying capacity of the aircraft as a function of fuel configuration selected and weapon type selected. The fuel configuration order in items five, six, seven and nine must be consistent. Likewise, the weapon type order in items seven and nine must be consistent. Items ten through twelve are not presently used by the program.

IV.1.21 WEAP: Weapons Effectiveness Table

The WEAP table defines the names and characteristics of the weapons of interest in the mission planning problem. This table consists of a single record (record 2) which must be created by the user. The contents of the table may be examined with the command "SHOW WEAP 2". The description of the WEAP table structure shown below is produced by the command "SHOW WEAP HELP".

WEAPONS EFFECTIVENESS TABLE STRUCTURE

NAME	TYPE	SIZE	LOC	TITLE
IDWP	CH04	1	1	ID = WEAP
PDWP	REAL	50	2	PK WEAP BY TG TYPE
NMTY	INT	1	52	NUMBER OF WEAP TYPES
NAME	CH08	10	53	NAME OF WEAPON
IDC	TIME	1	73	RECORD CREATION DATE
IDM	TIME	1	74	RECORD MODIFICATION DATE

The first item is the table ID, which is always "WEAP". Item two (PDWP) serves as a simplified version of the "Bomber's Encyclopedia." It consists of a 2-dimensional array of floating point numbers between 0 and 1. This array defines single shot probability of kill as a function of weapon type and target type. The array is currently dimensioned (10,25). The routing and allocation algorithms use these probabilities to determine the number of weapons and aircraft required to obtain the level of damage specified for each target. Therefore the weapon type index used in this list must be consistent with the corresponding index used in the items NWEP (table STGB), FCIN (table VEHP) and ISCL (table VEHP). Similarly, the target type index used in the list must be consistent with the value of item ITYP (table TG). Item three (NMTY) is the

number of weapon types (up to 10) being considered. Item four (NAME) is a list of up to 10 alphanumeric weapon type names. These names may be up to 8 characters long and should be listed in the order consistent with the weapon type index used in item PDWP described above.

IV.1.22 WFZ: Weapons Free Zone Table

The WFZ table is used to store the locations where the planner wishes to place weapons free air space. Each record contains one weapons free zone.

IV.1.22.1 WFZ Table Structure

The structure of the WFZ table is shown below. This table may be reproduced by typing "SHOW WFZ HELP".

WFZ TABLE STRUCTURE

NAME	TYPE	SIZE	LOC	TITLE
ID	CH08	1	1	ID OF WEAPON FREE ZONE
NPTS	INT	1	3	NUMBER OF BOUNDARY POINT
X	REAL	20	4	LONG-LAT OF WFZ BNDRY PT
IDC	TIME	1	24	RECORD CREATION DATE
IDM	TIME	1	25	RECORD MODIFICATION DATE

The first item in the WFZ table is the weapon free zone ID. This ID may be up to eight characters long and must begin with a letter. This ID can refer to the area or anything the user wishes. The second item (NPTS) is the number of boundary points of the area. There is a minimum of three boundary points which would be plotted as a triangle and a maximum of ten which would be plotted as a polygon with ten sides. The third item (X) is the weapon free zone position as longitude and latitude. Longitude and latitude are in decimal degrees. These points must be entered in contiguous order (either clockwise, or counterclockwise).

IV.1.22.2 WFZ Table Usage

The WFZ table is added by the user with the standard table ADD command.

Records can be changed, deleted, or copied. The data may be displayed by using the WF option in the DISPLAY command. At this time, WFZ's are only used for display purposes and will have no effect on the routes. It is assumed that the LLTR data is correct and no attempt is made to verify that WFZ's are in fact avoided by the current set of available LLTR's.

An example of a WFZ record is shown below.

```
CRSHOW -- RECORD #    2     IDWORD=DUSLDORF
         ID  =     DUSLDORF
         NPTS=           4
         X   = 6.2500E+00 5.1450E-01 7.2500E+00 5.1767E+01
               7.6667E+00 5.1500E+01 7.0000E+00 5.1083E+01
               0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
               0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
               0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
         IDC =     85/11/22 16:43
         IDM =     85/11/22 16:43
```

IV.2 ARRAYS

This section describes the arrays used by FLAPS plus two special data structures: the flight plan output and the digital terrain elevation data (DTED). Arrays are matrix oriented data structures which are created and maintained by the FLAPS software. Each four character array name is associated with a random access disk file (see the OPEN command in Section III). These disk files each consist of 2 or more 2400 word records. The first record of each array is a header record. This record contains information used by the file management software; data which is stored in an array begins in record 2.

The actual record-oriented format of an array is uninteresting to the user; it only needs to be understood by the program developer. For some of the arrays, a SHOW command (Section III.1.7) is available. The "SHOW arrays commands" format the data in a manner which is of interest to the user. The names and descriptions of the FLAPS data base arrays are listed below. This list may be produced by typing "SHOW HELP".

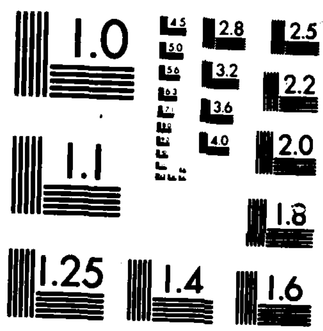
NAMES AND DESCRIPTIONS OF ARRAYS

ARCS	ARC WAYPOINT ARRAY
ARPE	TARG INGRESS/EGRESS PERF
ITGC	TARG ACCESSIBLE TO STGB
ITRC	TREX ACCESSIBLE TO TREN
NBOX	LIST OF TG BOX CORNERS
NLIS	LIST OF NODES
NPOS	NODE POSITIONS
ROUT	ROUT NODES DIST AND PERF

SXPE	STGB TO LLTR EXIT PERF
TGUS	TARGET STATUS ARRAY
TRPE	LLTR TREE PERFORMANCE

AD-A165 503 FORCE LEVEL AUTOMATED PLANNING SYSTEMS (FLAPS) USER'S MANUAL(U) SYSTEMS CONTROL TECHNOLOGY INC PALO ALTO CA S RAINBOLT ET AL. FEB 86 F61546-84-C-0080 3/4

UNCLASSIFIED F/G 15/7 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

IV.2.1 ARCS: The Arcs Coordinate Array

The ARCS array contains the coordinates of the optimal path segments between the targets and their accessible LLTR exit points. Each target and LLTR exit point pair will have an associated ingress and egress arc. The arc performance data for the arcs is stored in the Arc Performance Array (ARPE).

The arcs are stored and displayed in the form of waypoints. Each arc is made up of at least two waypoints. Each waypoint has the following form: time (in hours), longitude (in decimal degrees), latitude (in decimal degrees), above ground level altitude (in meters), and a node index. Time is the elasped time from the beginning of the arc. The first waypoint will always have time equal to 0.0. The node index refers to the node ID stored in the NLIS array. Only the first and last waypoints will have nonzero indices.

The ARCS array is created by the ARCS command. The user may show the ARCS array after this command has been executed. To show an arc, the user enters "SHOW ARCS". FLAPS then prompts the user for a target ID or index. Either may be entered, whichever is more convenient. Then, FLAPS prompts the user for an LLTR exit point ID or index. Again the user may enter either form. The user may show the NLIS array to determine the correspondence between the node ID's and indices. If the target and LLTR exit point pair are not accessible, FLAPS will give the user an error message. Accessible target and LLTR exit point pairs may be seen by showing the ITGC or ARPE arrays. The result of the SHOW ARCS command will be a listing of the ingress and egress arcs, in that order, as a sequence of waypoints. The form of the waypoints is described above.

The following table is the result of a "SHOW ARCS" command. The table could have been generated by entering:

SHOW ARCS CASLAV S133

or

SHOW ARCS 124 S133, or SHOW ARCS CASLAV 51

or

SHOW ARCS 124 51

VRARCS - ARRAY ARCS - 22 POINT INGRESS ARC FROM CASLAV (124) TO S133 (51)

TIME	LONGITUDE	LATITUDE	ALTITUDE	NODE
0.000	12.870	49.184	60.100	S133
0.023	12.824	49.000	60.100	
0.038	12.695	49.083	60.100	
0.049	12.565	49.083	60.100	
0.056	12.500	49.125	60.100	
0.062	12.500	49.167	60.100	
0.069	12.436	49.208	60.100	
0.081	12.371	49.292	60.100	
0.092	12.306	49.375	60.100	
0.119	12.241	49.583	60.100	
0.161	12.241	49.917	60.100	
0.183	12.436	50.042	60.100	
0.251	13.278	50.042	60.100	
0.335	14.315	49.958	60.100	
0.342	14.380	49.917	60.100	
0.353	14.510	49.917	60.100	
0.360	14.575	49.875	60.100	
0.366	14.639	49.875	60.100	
0.377	14.769	49.917	60.100	
0.392	14.899	50.000	60.100	
0.418	15.223	50.000	60.100	
0.433	15.383	49.950	60.100	CASLAV

VRARCS - ARRAY ARCS - 28 POINT EGRESS ARC FROM CASLAV (124) TO S133 (51)

TIME	LONGITUDE	LATITUDE	ALTITUDE	NODE
0.000	15.383	49.950	60.100	CASLAV
0.003	15.417	49.958	60.100	
0.010	15.482	50.000	60.100	
0.026	15.482	50.125	60.100	

0.041	15.353	50.208	60.100	
0.056	15.158	50.208	60.100	
0.064	15.093	50.167	60.100	
0.069	15.028	50.167	60.100	
0.076	14.964	50.125	60.100	
0.092	14.769	50.125	60.100	
0.114	14.575	50.000	60.100	
0.140	14.251	50.000	60.100	
0.148	14.186	49.958	60.100	
0.221	13.278	50.042	60.100	
0.274	12.630	50.042	60.100	
0.281	12.565	50.000	60.100	
0.297	12.371	50.000	60.100	
0.311	12.241	49.917	60.100	
0.353	12.241	49.583	60.100	
0.380	12.306	49.375	60.100	
0.391	12.371	49.292	60.100	
0.403	12.436	49.208	60.100	
0.411	12.500	49.167	60.100	
0.416	12.500	49.125	60.100	
0.423	12.565	49.083	60.100	
0.434	12.695	49.083	60.100	
0.449	12.824	49.000	60.100	
0.472	12.870	49.184	60.100	S133

IV.2.2 ARPE: Arc Performance Array

The ARPE array contains the distance and probability of survival for each arc generated by the ARCS command. For each target and each accessible LLTR exit point there is an ingress and egress arc. The accessible LLTR exit points for a given target can be seen by showing the ITGC array. The ARPE array contains the probability of survival and distance for each of these ingress and egress arcs.

The ARPE array is closely related to the Arc Coordinate Array (ARCS). The data is stored separately because only the performance data is needed to do the route construction (ROUT) and target allocation (ALLOCATE).

The Arc Performance Array is generated by the ARCS command. The user may show the this array after the ARCS command has been run. To show this array the user types "SHOW ARPE". FLAPS will then prompt the user to enter a target index, a target ID, "ALL", or "/". If the user wishes to see the performance of the arcs for a specific target, the target index or target ID may be entered, whichever is more convenient. If all of the arc performances are required, the user may enter "ALL". A "/" will cause the SHOW command to abort, and control will return to the main program. The output will be in the following form: "ID #" refers to the target ID name, "INDEX" refers to the NLIS indices. The ingress and egress route distances and probabilities of survival are then shown. The following table was generated by FLAPS. It shows the arc performances for target "CASLAV". The user could have entered either:

SHOW ARPE CASLAV

or

SHOW ARPE 124

to generate this table.

WRPERF -- ARRAY ARPE -- ARC PERFORMANCES FROM CASLAV (124)

			INGRESS		EGRESS	
	ID #	INDEX	DIST (NM)	PS	DIST (NM)	PS
1	N005	48	299.89	0.6495	317.05	0.5724
2	N028	49	265.22	0.6378	282.38	0.5622
3	S092	50	146.60	0.6588	165.64	0.5798
4	S133	51	207.08	0.4612	226.11	0.4074

IV.2.3 ITGC: Target Accessibility Array

The ITGC array is a list of all of the paths that one can take to a given target provided he returns to his staging base on the shortest distance path. This array is used to determine which LLTR exit points should have arcs built from them to the target when the ARCS command is given. Building arcs is a time consuming process. By carefully applying accessibility rules, the number of arcs which need to be built can be kept to a minimum. For example, there is no need to build arcs to a target from a staging base (via a LLTR exit) if that staging base does not have weapons which will be effective against that target.

There is one ITGC record for every target which has at least one staging base accessible to it. Each line in the record corresponds to a potential path from a staging base to the target. The path is uniquely specified by giving the staging base, LLTR entry point and the LLTR exit point which would be used to reach the target. With this information, the actual LLTR node sequence can be retrieved from array ITRC.

The ITGC array has a one-to-one correspondence with the Staging Base to LLTR Exit Performance (SXPE) Array. That is, one would use the ITGC array to find the Staging Base to LLTR entry to LLTR exit paths that are feasible for a given target and then use the SXPE array to find the distance and probability of survival along the path from the Staging Base to the LLTR exit.

The Target Accessibility Array is generated by issuing the ACCESS command. Changes to the STGB, LLTR, TG, WEAP and VEHP tables may make the ITGC array have stale data. The following ITGC record could have been generated by FLAPS by issuing the command "SHOW ITGC CASLAV" or the command "SHOW ITGC 124".

If all ITGC records are desired, the command would be "SHOW ITGC ALL".

WRACC -- THERE ARE 24 PATHS TO TARGET CASLAV (124) IN ARRAY ITGC

	STAGING BASE		LLTR ENTRY		LLTR EXIT	
1	FAIRFORD	(1)	N001	(21)	N005	(48)
2	FAIRFORD	(1)	N031	(22)	N028	(49)
3	FAIRFORD	(1)	S079	(23)	S092	(50)
4	FAIRFORD	(1)	S113	(24)	S133	(51)
5	LAKENHTH	(2)	N001	(21)	N005	(48)
6	LAKENHTH	(2)	N031	(22)	N028	(49)
7	LAKENHTH	(2)	S079	(23)	S092	(50)
8	LAKENHTH	(2)	S113	(24)	S133	(51)
9	MILDENHA	(3)	N001	(21)	N005	(48)
10	MILDENHA	(3)	N031	(22)	N028	(49)
11	MILDENHA	(3)	S079	(23)	S092	(50)
12	MILDENHA	(3)	S113	(24)	S133	(51)
13	RAMSTEIN	(8)	N031	(22)	N005	(48)
14	RAMSTEIN	(8)	N031	(22)	N028	(49)
15	RAMSTEIN	(8)	S079	(23)	S092	(50)
16	RAMSTEIN	(8)	S113	(24)	S133	(51)
17	SEMBACH	(9)	N001	(21)	N005	(48)
18	SEMBACH	(9)	N031	(22)	N028	(49)
19	SEMBACH	(9)	S079	(23)	S092	(50)
20	SEMBACH	(9)	S113	(24)	S133	(51)
21	LAHR	(10)	N031	(22)	N005	(48)
22	LAHR	(10)	N031	(22)	N028	(49)
23	LAHR	(10)	S079	(23)	S092	(50)
24	LAHR	(10)	S113	(24)	S133	(51)

IV.2.4 ITRC: Low Level Transit Route Access Array

The ITRC array contains the optimal LLTR node sequences from a given LLTR entry point to every LLTR exit point which can be reached from that entry point. It also shows the distance through the network in nautical miles and the probability of arriving at the LLTR exit given one left from the LLTR entry. Even though the route from the LLTR entry point to the LLTR exit point is not contained in the statespace, and therefore is not exposed to any threat danger, the probability of survival will be slightly less than 1.0. This is due to the small "air danger" penalty. The same is also true for the TRPE and SXPE arrays. The distance and probability of arrival does not change on ingress or egress. The LLTR node sequence on egress is simply the reverse of the sequence on ingress. Therefore, one can read down the list to find the optimal path from the entry point to the exit (for ingress) and up the list to find the optimal path from the exit back to the entry point (for egress).

The Low Level Transit Route Access Array has a direct correspondence to the Transit Route Performance (TRPE) Array. That is, one would use the ITRC array to find the optimal node sequence through the LLTR network and the TRPE array to find the distance and probability of arrival along this path.

The ITRC array is created by issuing the NODES command. There are as many ITRC records as there are LLTR entry points which are accessible to at least one exit point. An individual ITRC record can be shown by specifying the alphanumeric LLTR entry point name or its unique NLIS index. All ITRC records can be displayed by giving the "SHOW ITRC ALL" command. The following sample ITRC table could have been generated by FLAPS by either issuing the "SHOW ITRC N031" or "SHOW ITRC 22" commands.

```
WRTREE -- THERE ARE  2 EXITS ACCESSIBLE TO LLTR ENTRY POINT N031  ( 22)

     BRANCH FOR LLTR EXIT N005       (    48)    DIST =    144.44    PA =  0.9946

              1      N031      (     22)
              2      N030      (     33)
              3      N023      (     28)
              4      N002      (     25)
              5      N003      (     26)
              6      N004      (     27)
              8      N005      (     48)

     BRANCH FOR LLTR EXIT N028       (    49)    DIST =    134.20    PA =  0.9950

              1      N031      (     22)
              2      N030      (     33)
              3      N023      (     28)
              4      N024      (     29)
              5      N025      (     30)
              6      N026      (     31)
              7      N027      (     32)
              9      N028      (     49)
```

IV.2.5 MASK: Mask Array File

The MASK array is an internal file to the software and is not accessible to the user. The mask array is a temporary array file that is used during the masking function. It is stored in a polar coordinate system centered around the location of the threat. It consists of a set of rays emanating from the threat that are spaced equal angles apart in degrees. Along each ray is a set of points that are spaced equal distances apart. The minimum observable altitude is calculated for each point along the ray, and the ray is then written out to the mask file. Then, the mask file is read and transformed into X,Y coordinates. The new array is then stored in the file "TOBS" for later use in creating and modifying the statespace, implementing threat suppression, and analyzing routes. The parameters for creating the mask array are stored in file "MSKEXT". See SCT Technical Memo 5398-300 titled "TERRAIN MASKING ALGORITHM" for a detailed description of how the mask array file is created. This file is not available for showing by the user. The default dimensions for this array are shown below. Where the number of rays = 120 and the number of points along a ray = 125.

MASK = 1 1 120 125

IV.2.6 NBOX: Node Box Array

The NBOX array consists of the coordinates of a box around each target. The box is stored in the form: minimum longitude, maximum longitude, minimum latitude, and maximum latitude. All coordinates are in decimal degrees. The box defines the region over which the dynamic programming algorithm (DPA) will be run. Besides the target, the box contains all of the accessible LLTR exit points. These accessible LLTR exit points can be seen by showing the ITGC array. The optimal ingress and egress routes, from each LLTR exit point to the target will be contained within the box.

The Node Box Array is generated by the ACCESS command. The user may show this array after this command has been run. To show this array the user simply types "SHOW NBOX". No other inputs are required. The output will be in the following form: "ID #" refers to the target ID name, "INDEX" refers to the NLIS indices. The box coordinates are in decimal degrees. The following table was generated by FLAPS after a "SHOW NBOX" was entered.

WRBOX -- ARRAY NBOX -- DPA BOX LIMITS

ID #	INDEX	MIN LONG	MAX LONG	MIN LAT	MAX LAT
PANENSKY	121	9.2	14.1	49.0	51.3
ZOLLSCHN	122	9.2	13.0	49.0	51.4
PRESCHEN	123	9.2	14.8	49.0	51.8
CASLAV	124	9.2	15.5	49.0	51.3
LEIPZIG	125	9.2	13.0	49.0	51.6
PRAGUE	126	9.2	14.4	49.0	51.3

IV.2.7 NLIS: Node List Array

The NLIS array is an ordered list of all active nodes in the current scenario. The nodes are ordered in the sense that they are grouped by type. That is, the first entries in the list are the staging bases. Next comes the LLTR entry points, followed by the LLTR intermediate points and then the LLTR exit points. At the end of the list is the targets.

The NLIS array only contains active nodes. Therefore, it does not include any staging bases or LLTR points that are not contained within in the scenario boundaries. Similarly, it does not include any targets that do not lie within the statespace boundaries. It also excludes LLTR nodes which are turned off. Keeping this list as small as possible by excluding nodes that will not be usable increases processing speed and minimizes computer memory usage.

The structure of NLIS is very simple since it only has two elements: the eight character alphameric node name and its unique integer index. These indices can be used in commands to specify a node instead of typing in the alphameric node ID. Care must be taken that a current version of NLIS is used since the indices can change as nodes become active or inactive (i.e. when the NODES command is given after changing STGB, LLTR or TG data bases or changing the statespace or scenario boundaries).

There is only one NLIS array record. Usually, it is suggested that the Node Position Array (NPOS) be used since it contains all of the information in NLIS and the node position information.

The NLIS array is generated by the NODES command. To show this array the user simply types "SHOW NLIS". The following table was generated by FLAPS by issuing the "SHOW NLIS" command.

WRLIS -- ARRAY NLIS LIST OF ID NAMES

INDEX	ID NAME
1	FAIRFORD
2	LAKENHTH
3	MILDENHA
4	BENTWATE
5	BITBURG
6	SPANGDAH
7	HAHN
8	RAMSTEIN
9	SEMBACH
10	LAHR
11	SOLLING
12	WIESBADN
21	N001
22	N031
23	S079
24	S113
25	N002
26	N003
27	N004
28	N023
29	N024
30	N025
31	N026
32	N027
33	N030
34	S080
35	S081
36	S082
37	S085
38	S086
39	S091
40	S112
41	S126
42	S127
43	S128
44	S129
45	S130
46	S131
47	S132
48	N005
49	N028
50	S092

51	S133
121	PANENSKY
122	ZOLLSCHN
123	PRESCHEN
124	CASLAV
125	LEIPZIG
126	PRAGUE

IV.2.8 NPOS: Node Position Array

The NPOS array is very similar to the Node List Array (NLIS). It contains all of the NLIS information and all of the comments about NLIS apply to NPOS (see Section IV.2.7). The major difference between the two arrays is that NPOS also includes the longitude and latitude positions of the nodes (in decimal degrees with the convention that east is positive for longitude and north is positive for latitude).

It is suggested that the NPOS list be used instead of the NLIS since it contains more information and is therefore more useful. The NPOS array is generated by the NODES command and will change when this command is given if there have been changes made to the STGB, LLTR or TG data bases or to the boundaries of the statespace or scenario. The following is an example of a Node Position Array generated by FLAPS by issuing the "SHOW NPOS" command.

WRPOS -- ARRAYS NPOS

ID NAME	INDEX	LONG	LAT
FAIRFORD	1	-1.75	51.58
LAKENHTH	2	0.58	52.40
MILDENHA	3	0.50	52.37
BENTWATE	4	1.42	52.13
BITBURG	5	6.53	49.97
SPANGDAH	6	6.67	49.93
HAHN	7	7.25	49.93
RAMSTEIN	8	7.57	49.43
SEMBACH	9	7.88	49.50
LAHR	10	7.93	48.37
SOLLING	11	8.08	48.78
WIESBADN	12	8.33	50.05
N001	21	6.94	50.45
N031	22	7.07	49.59
S079	23	7.65	49.29
S113	24	8.34	48.66
N002	25	7.44	50.45
N003	26	7.99	50.78
N004	27	8.59	51.03

N023	28	7.21	50.09
N024	29	7.65	50.18
N025	30	8.46	50.24
N026	31	8.97	50.29
N027	32	9.12	50.50
N030	33	6.95	49.89
S080	34	8.11	49.20
S081	35	8.91	49.14
S082	36	9.31	49.16
S085	37	10.07	49.14
S086	38	10.51	49.36
S091	39	11.20	49.40
S112	40	8.25	48.98
S126	41	8.52	48.35
S127	42	8.98	48.36
S128	43	9.55	48.32
S129	44	10.36	48.27
S130	45	11.13	48.46
S131	46	11.79	48.65
S132	47	12.22	48.93
N005	48	9.38	51.19
N028	49	9.56	50.60
S092	50	11.91	49.74
S133	51	12.87	49.18
PANENSKY	121	13.93	50.32
ZOLLSCHN	122	12.12	51.27
PRESCHEN	123	14.65	51.65
CASLAV	124	15.38	49.95
LEIPZIG	125	12.45	51.43
PRAGUE	126	14.27	50.12

IV.2.9 ROUT: Route Array

The ROUT array contains a summary of the hypothetical sorties generated by the command "RO". Each sortie consists of a round trip route-aircraft-weapon combination which is optimal for its target and staging base. The criterion for optimality is to minimize the expected number of lost aircraft among all feasible route-aircraft-weapon combinations. Feasible here means that the proposed combination is consistent with the aircraft fuel and weapon characteristics defined in table VEHP, and achieves the probability of damage specified for the target in table TG.

The hypothetical sorties assigned to a particular target may be examined using the "SHOW" command by specifying either the target index or the target ID as in "SHOW ROUT 124" or "SHOW ROUT CASLAV". In addition all hypothetical sorties may be examined with the command "SHOW ROUT ALL". Illustrated below is the summary of a sortie assigned to target Caslav.

T A R G E T : CASLAV PD ACHIEVED : 0.9612

	STAGING BASE	LLTR ENTRY	LLTR EXIT	DIST (NM)	PS	A/C	WEAP TYPE	EXP LOSSES
IN	FAIRFORD	S079	S092	710.3	0.645			
EG	FAIRFORD	S079	S092	729.3	0.568			
TOTAL				1439.5	0.366	2 F111	MARK-20	1.268

The probability of target damage (PD) shown in this summary represents only the effect of the proposed weapons package on the target - it does not reflect the probability of survival (PS) of the proposed route. Thus, the value of PD must be regarded as a probability of damage assuming the successful arrival of the aircraft at the target.

The detailed routes for the sorties in the ROUT array may be displayed graphically by using the DISPLAY ROUTE command and analyzed for threat exposure using the ANALIZ command. However, it is first necessary that the routes be selected with the SELECT command.

IV.2.10 STAT: Statespace Array

The STAT array is an internal file that is used by the software and is not available for showing to the user. It is stored in an X,Y coordinate system. The statespace array file covers the operational area of interest for one operational altitude. The parameters for the statespace array are stored in the parameter files ALGP and GEOM. STAT contains the danger values for a given altitude. Prior to applying suppression, this data is derived from the three dimensional statespace array TH3D. The PROCESS and STATESPACE ALTOPT commands, described in Section III, prompt the user to indicate which altitude level he wants loaded into STAT. The SUPPRESS command, described in Section III.1.4, re-calculates STAT to take into account the lower levels of danger produced by the suppression assets. The STAT array is used to display danger contours, create minimum lethality routes from the staging base to the targets and back, and to analyze routes. The current default dimensions for this array are as shown below, where the number of flight directions = 8, the number of altitudes = 1, the number of longitude increments = 101, the number of latitude increments = 114. These file dimensions are printed out when STAT is opened by the initialization file ZCONTNU.DAT.

STAT = 8 1 101 114

IV.2.11 SXPE: Staging Base To LLTR Exit Performance Array

The SXPE array gives the distance in nautical miles and probability of arrival performance data for the optimal path from a staging base to a LLTR exit. This array corresponds record-by-record and row-by-row with the Target Accessibility Array (ITGC). Therefore, there is one record for every target which has at least one staging base accessible to it; and, each row of a record contains the performance data for the optimal path from the staging base to a LLTR exit on a path to the target.

The following sample SXPE table could have been generated by FLAPS either by entering the command "SHOW SXPE LEGNICA" or by entering the command "SHOW SXPE 135". If all of the SXPE records are desired, the command "SHOW SXPE ALL" can be entered.

```
WRSXPE -- THERE ARE    24 PATHS TO TARGET CASLAV    (  124)

   PATHS FOR STAGING BASE FAIRFORD (     1)

              LLTR EXIT                    DISTANCE        PROB OF ARRIVAL
                                           TO  EXIT            AT EXIT

         1     N005      (    48)           441.12             0.9836
         2     N028      (    49)           490.58             0.9817
         3     S092      (    50)           563.65             0.9790
         4     S133      (    51)           634.06             0.9764

   PATHS FOR STAGING BASE LAKENHTH (     2)

              LLTR EXIT                    DISTANCE        PROB OF ARRIVAL
                                           TO  EXIT            AT EXIT

         5     N005      (    48)           371.29             0.9861
         6     N028      (    49)           431.36             0.9839
         7     S092      (    50)           505.42             0.9812
         8     S133      (    51)           579.59             0.9784

   PATHS FOR STAGING BASE MILDENHA (     3)

              LLTR EXIT                    DISTANCE        PROB OF ARRIVAL
                                           TO  EXIT            AT EXIT
```

IV.2.12 TGUS: Target Status Array

The TGUS array is derived from the ROUT array by the weapons allocation command "AL". The weapons allocation procedure is to examine the targets in order of decreasing priority and to select for each the feasible sortie from the ROUT array with minimum expected aircraft losses. Feasible here means that the total number of aircraft allocated from any given staging base does not exceed the aircraft inventory for that base as defined in the staging base table STGB, that the aircraft have weapons available that can destroy the target, and that the aircraft can carry enough fuel to reach the target and return. The array TGUS consists of a one line summary of each of these selected sorties listed in order of decreasing target priority.

The contents of TGUS, which resembles an air tasking order (ATO), is examined using the command "SHOW TGUS". One sample is illustrated below.

TARGET	STAGING BASE	AIRCRAFT ALLOCATED	WEAPON TYPE	PD ACHIEVED	ROUTE PS	ROUTE DIST (NM)
PANENSKY	LAKENHTH	2 F111	CBU-38	0.878	0.40	1208.8
ZOLLSCHN	FAIRFORD	4 F111	MARK-84	0.990	0.22	1398.8
PRESCHEN	RAMSTEIN	2 F-16	MARK-20	0.900	0.33	709.8
CASLAV	MILDENHA	2 F111	MARK-20	0.961	0.37	1326.2
LEIPZIG	RAMSTEIN	4 F-16	AGM-65	0.999	0.37	695.7
PRAGUE	HAHN	4 F-16	AGM-65	0.999	0.39	661.3

As in the array ROUT, the probability of damage (PD) appearing in TGUS reflects only the effects of the selected weapon package on the target - not the probability of survival of the route (PS).

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The contents of TGUS, which resembles an air tasking order (ATO), is examined using the command "SHOW TGUS". One sample is illustrated below.

TARGET	STAGING BASE	AIRCRAFT ALLOCATED	WEAPON TYPE	PD ACHIEVED	ROUTE PS	ROUTE DIST (NM)
PANENSKY	LAKENHTH	2 F111	CBU-38	0.878	0.40	1208.8
ZOLLSCHN	FAIRFORD	4 F111	MARK-84	0.990	0.22	1398.8
PRESCHEN	RAMSTEIN	2 F-16	MARK-20	0.900	0.33	709.8
CASLAV	MILDENHA	2 F111	MARK-20	0.961	0.37	1326.2
LEIPZIG	RAMSTEIN	4 F-16	AGM-65	0.999	0.37	695.7
PRAGUE	HAHN	4 F-16	AGM-65	0.999	0.39	661.3

As in the array ROUT, the probability of damage (PD) appearing in TGUS reflects only the effects of the selected weapon package on the target - not the probability of survival of the route (PS).

As the above illustration shows, there may be targets for which no suitable sortie can be found. Since weapons and aircraft are allocated to targets in order of decreasing target priority, this is particularly likely for the lower priority targets appearing at the bottom of the list.

IV.2.13 TH3D: Three Dimensional Statespace Array File

The TH3D array is an internal file that is used by the software and is not available for showing to the user. It is stored in an X,Y coordinate system. The array "TH3D" covers the operational area of interest for all the operational altitudes. The parameters for "TH3D" are stored in the parameter files "ALGP" and "GEOM". To load data into array "TH3D" you type the commands "ST AD" with the appropriate parameters as prompted. This causes the software to read the threat observability file and calculate the danger values which are then stored in array "TH3D". The array "TH3D" is used to load data into the array "STAT" for doing minimum lethality route calculations and threat suppression. The danger values in "TH3D" can be displayed by using the display commands described elsewhere in this document. The current default dimensions for this array are as shown below, where the number of flight directions = 8, the number of operational altitudes = 5, the number of longitude increments = 101, and the number of latitude increments = 114. These file dimensions are printed out when TH3D is opened by the initialization file ZCONTNU.DAT.

TH3D = 8 5 101 114

IV.2.14 TOBS: Threat Observability Array File

The TOBS array is an internal file that is used by the software, and is not available for showing by the user. The "TOBS" array contains the minimum observable altitude for each threat that has been masked by the FLAPS program. The data for each threat is stored in a subarray in the "TOBS" file using an X,Y coordinate system centered around the threat location. The data is stored in sixteen bit integers in units of meters. The subarray is intialized to 32764 meters before terrain masking. The "TOBS" file has as a header an information word, and two arrays. The information word gives the number of threats that have been masked and stored in the "TOBS" file. The first array consists of 8 character words that identify the threats that have been masked. And the second array consist of integer words that are pointers to the threat subarrays in the "TOBS" file. The "TOBS" file is dimensioned as shown below where 256000 is the available size of the "TOBS" file. The "TOBS" file is used in adding or deleting threats from the statespace, doing threat suppression, and doing route analysis. The following file dimensions are printed out when TOBS is opened by the initialization file ZCONTNU.DAT.

TOBS = 256000 1 1 1

IV.2.15 TRPE: Low Level Transit Route Performance Array

The TRPE array gives the performance data for the optimal node sequences through the LLTR network. Performance, in this case, is the distance in nautical miles from an LLTR entry point to an LLTR exit point and the probability of arrival at the LLTR exit given one left from the LLTR entry point.

This array corresponds record-by-record and row-by-row with the Low Level Transit Route Accessibility (ITRC) Array. Therefore, there is one record for every LLTR entry point which has at least one LLTR exit point accessible to it; and, every row in a record contains the performances from the entry point to an accessible exit point. Because LLTR exits lie on the friendly side of the FEBA, there is no directionality included in the probability of arrival calculations. This means that the probability of arrival at the LLTR exit given one left from the LLTR entry is the same as the probability of arrival at the LLTR entry given that one left from the LLTR exit.

The following TRPE example could have been generated by FLAPS either by issuing the command "SHOW TRPE NO31" or by issuing the command "SHOW TRPE 22". If all of the TRPE records had been desired to be shown, the proper command would have been "SHOW TRPE ALL".

WRTRPE -- THERE ARE 2 EXITS ACCESSIBLE TO LLTR ENTRY POINT NO31 (22)

	LLTR EXIT		DISTANCE	PROB OF ARRIVAL
1	NOO5	(48)	144.44	0.9946
2	NO28	(49)	134.20	0.9950

IV.2.16 THE FLIGHT PLAN (SPED)

A flight plan may be generated from routes stored in the SPED table and displayed on the users terminal. This flight plan is in an easily interpreted form. It is recommended that users use this feature instead of the "SHOW SPED" command.

The form of the flight plan is as follows. A header is printed which gives the name of the sortie (the SPED table record ID), the ID and index of the staging base and target, the total probability of survival, the probability of kill due to threats, the flight distance (in nautical miles), the take off time (in decimal minutes), the time on target (in decimal minutes), and the number of waypoints. These are all labeled. Refer to Section IV.1.11 for a description of the SPED table. The actual flight plan is shown as a list of waypoints. Each waypoint consists of time (in decimal minutes), latitude and longitude (in degrees, minutes and seconds), altitude (in feet), heading (in decimal degrees from north), and the node ID. A node ID will appear at the first and last waypoint (the staging base), at the target, and at all of the LLTR points. Simple turn points do not have a node ID listed.

To show a flight plan, the user should type "SHOW PLAN". FLAPS will then prompt the user for a SPED record ID or a record number. The user may enter either, whichever is more convenient. The following table was generated by FLAPS using the SHOW PLAN command for a SPED record with ID BITB.CASL.01, and record number 6. The plan could have been generated by entering either:

SHOW PLAN BITB.CASL.01

or

SHOW PLAN 6

WRPLAN - FLIGHT PLAN FOR SORTIE: LAKE.PANE.01

STAGING BASE LAKENHTH (2) TO TARGET PANENSKY (121)
PROB OF SURVIVAL: 0.4026 THREAT PK: 0.5971
FLIGHT DISTANCE: 1208.75 NM
TAKE OFF TIME: 0.0000 TIME ON TARGET: 75.0913 # OF WAYPOINTS: 35

TIME (MIN)	LATITUDE (DMS)	LONGITUDE (DMS)	ALTITUDE (FEET)	HEADING (DEG)	NODE ID
0.000	52 24 00	0 34 60	197.18	124.01	LAKENHTH
40.891	49 17 17	7 39 15	197.18	105.47	S079
43.238	49 12 17	8 06 54	197.18	97.30	S080
47.171	49 08 18	8 54 31	197.18	85.42	S081
49.150	49 09 33	9 18 35	197.18	92.52	S082
52.912	49 08 14	10 04 26	197.18	52.03	S085
55.614	49 21 29	10 30 30	197.18	84.89	S086
59.036	49 23 55	11 12 16	197.18	53.47	S091
63.336	49 44 18	11 54 50	197.18	47.82	S092
66.741	50 02 30	12 26 08	197.18	84.80	
70.196	50 04 60	13 08 55	197.18	60.13	
72.716	50 15 00	13 36 08	197.18	44.80	
73.599	50 19 60	13 43 55	197.18	0.00	
73.912	50 22 30	13 43 55	197.18	90.00	
74.534	50 22 30	13 51 42	197.18	141.89	
75.091	50 19 00	13 55 60	197.18	124.02	PANENSKY
75.427	50 17 30	13 59 29	197.18	44.80	
75.869	50 19 60	14 03 22	197.18	315.23	
76.310	50 22 30	13 59 29	197.18	270.00	
77.554	50 22 30	13 43 55	197.18	180.00	
77.867	50 19 60	13 43 55	197.18	224.85	
78.750	50 15 00	13 36 08	197.18	240.21	
81.270	50 04 60	13 08 55	197.18	262.87	
83.792	50 02 30	12 37 48	197.18	225.00	
84.235	50 00 00	12 33 55	197.18	270.00	
85.175	50 00 00	12 22 15	197.18	228.43	
88.137	49 44 18	11 54 50	197.18	233.66	S092
92.437	49 23 55	11 12 16	197.18	264.90	S091
95.859	49 21 29	10 30 30	197.18	232.16	S086
98.562	49 08 14	10 04 26	197.18	272.52	S085
102.323	49 09 33	9 18 35	197.18	265.43	S082
104.303	49 08 18	8 54 31	197.18	277.31	S081
108.235	49 12 17	8 06 54	197.18	285.49	S080
110.582	49 17 17	7 39 15	197.18	305.80	S079
151.473	52 24 00	0 34 60	197.18	305.80	LAKENHTH

IV.2.17 THE BYTE (BYTE) ARRAY FILE

The byte array file is an internal file that is used by the software and is not available for showing to the user. It contains byte packed DTED data that is in an SCT format. To change the area of operation requires formatting a new data file. This file is used during the terrain masking process. This file has a header shown below that is described for the current scenario as, minimum longitude = 11 degrees east, minimum latitude = 48 degrees north, maximum longitude = 20 degrees east, maximum latitude = 54 degrees north. The following file dimensions are printed out when BYTE is opened by the initialization file ZCONTNU.DAT.

```
LUNTER,MXRCTR= 0 0

IHDR= 11.  48.  20.  54.  200 240 8 16
```

CHAPTER V

SAMPLE FLAPS SESSION

The following is a sample FLAPS interactive session. It was taken directly from a FLAPS log file (FOR004.DAT) which was generated during an actual FLAPS session. Some explanation has been added, but the output below is typical of what the user sees when he running FLAPS.

There are a number of standard features of which the user should be aware. These are:

(1) The Colon (:) Prompt. FLAPS presents the user with a colon when it is ready for a command. The user inputs follow the colon. To make the listing below easier to read, user inputs are enclosed in brackets, like this < ... >. Explanations appear in mixed case and are inside parentheses.

(2) The Type-Ahead Feature. In the sample session, the user inputs are typed as a single line of data consisting of several commands. For example, < SHOW ALGP 2 >. The user could also issue this command one word at a time, by typing < SHOW > <cr> < ALGP > <cr> < 2 > <cr>, where <cr> represents the carriage return key. If the command is issued one word at a time, then the program provides a helpful prompt each time the carriage return key is hit. This reminds the user what information is required next.

(3) The Timing Data. After a FLAPS command has been executed, a line is written to the screen and to the log file which tells the user how much time it took to process that command. The timing data includes the computer CPU time, the wall clock time, and the "Page Faults". Page Faults refers to the virtual operating system.

SAMPLE SESSION

```
FLAPS  --  DATE =  1-JAN-86      TIME = 10:43:59

Read in previous flaps files "Y"es or "N"o?:

< Y >
;
;    NORMAL RUN
;
:  OPEN TSTR OLD TSTR.FIL  R
    TSTR  NREC,LREC=     23  1212
:  INIT
:  OPEN ASTR OLD ASTR.FIL  R
    ASTR  NREC,LREC=     20    10
:  INIT
;
;   OPEN TABLES
;
:  OPEN ALGP OLD ALGP.FIL  R/W
```

```
 ALGP  NREC,LREC=      2    29
: OPEN CURR OLD CURR.FIL  R/W
  CURR  NREC,LREC=      2    24
: OPEN CMDL OLD CMDL.FIL  SR
 CMDL  NREC,LREC=      1   130
: OPEN DISP OLD DISP.FIL  R/SW
 DISP  NREC,LREC=      4    39
: OPEN GEOM OLD GEOM.FIL  R/SW
 GEOM  NREC,LREC=      2    38
: OPEN LLTR OLD LLTR.FIL  R/W
 LLTR  NREC.LREC=     88    14
: OPEN NODP OLD NODP.FIL  R/SW
 NODP  NREC,LREC=      2     9
: OPEN PBOR OLD PBOR.FIL  R
 PBOR  NREC,LREC=     15   205
: OPEN ROZ OLD ROZ.FIL    R/W
 ROZ   NREC,LREC=      6    27
: OPEN SPED OLD SPED.FIL  R/SW
 SPED  NREC,LREC=     17   733
: OPEN STCH OLD STCH.FIL  R/W
 STCH  NREC,LREC=     12   113
: OPEN STGB OLD STGB.FIL  R/W
 STGB  NREC,LREC=     13    18
: OPEN SUPM OLD SUPM.FIL  R/W
 SUPM  NREC,LREC=      4    81
: OPEN SUPP OLD SUPP.FIL  R/W
 SUPP  NREC,LREC=      7     9
: OPEN SWCH OLD SWCH.FIL  R/W
 SWCH  NREC,LREC=      2    28
: OPEN TG OLD TG.FIL      R/W
 TG    NREC,LREC=      7    10
: OPEN THRT OLD THRT.FIL  R/W
 THRT  NREC,LREC=     98     9
: OPEN TMDL OLD TMDL.FIL  R/W
 TMDL  NREC,LREC=     22   219
: OPEN VEHP OLD VEHP.FIL  R/W
 VEHP  NREC,LREC=      4    61
: OPEN WEAP OLD WEAP.FIL  R/W
 WEAP  NREC,LREC=      2   274
: OPEN WFZ OLD WFZ.FIL    R/W
 WFZ   NREC,LREC=      4    25
;
;  OPEN ARRAYS
;
: OPEN ALTG OLD ALTG.FIL  SR/W
 ALTG =        8       1       97      109
: OPEN ALTS OLD ALTS.FIL  SR/W
 ALTS =        8       1       97      109
: OPEN ARCS OLD ARCS.FIL  R/SW
 ARCS =   432660       1        1        1
: OPEN ARPE OLD ARPE.FIL  R/SW
 ARPE =     2460       1        1        1
```

```
: OPEN CL3D OLD CL3D.FIL  SR/W
   CL3D =          1        1        1        1
: OPEN ITGC OLD ITGC.FIL  R/SW
   ITGC =      13560        1        1        1
: OPEN ITRC OLD ITRC.FIL  R/SW
   ITRC =       3220        1        1        1
: OPEN NBOX OLD NBOX.FIL  R/SW
   NBOX =        120        1        1        1
: OPEN NLIS OLD NLIS.FIL  R/SW
   NLIS =        300        1        1        1
: OPEN NPOS OLD NPOS.FIL  R/SW
   NPOS =        300        1        1        1
: OPEN ROUT OLD ROUT.FIL  R/SW
   ROUT =       9060        1        1        1
: OPEN STAT OLD STAT.FIL  SR/W
   STAT =          8        1       97      109
: OPEN SXPE OLD SXPE.FIL  R/SW
   SXPE =       9000        1        1        1
: OPEN TGUS OLD TGUS.FIL  R/SW
   TGUS =        300        1        1        1
: OPEN TH2D OLD TH2D.FIL  SR/W
   TH2D =          8        1       97      109
: OPEN TH3D OLD TH3D.FIL  SR/W
   TH3D =          8        3       97      109
: OPEN TOBS OLD TOBS.FIL  SR/W
   TOBS =     256000        1        1        1
: OPEN TRPE OLD TRPE.FIL  R/SW
   TRPE =        400        1        1        1
;
;    TEMPORARY TERRAIN MASKED FILE
;
: OPEN MASK OLD MASK.FIL  SR/W
   MASK =          1        1       60       46
;
;    OPEN BYTE PACKED TERRAIN DATA
;
 OPEN BYTE OLD DRA1:[FLAPS.TEST]Z8E48N.ZOT   SR
LUNTER,MXRCTR=        0        0
  IHDR=       8.       48.       16.       54.  200  400    8   16

: PR GE
: DB 5
;
```

(The above is an example of how the user begins a FLAPS session. ZCONTNU.DAT (z-continue) is a command file which opens all of the arrays and tables. These arrays and tables contain all of the work done in previous sessions. See Chapter IV for a discription of the arrays and tables. ZCONTNU issues the "PROC GEOM" and "DEBUG 5" commands. These commands initialize the

critical data bases and set the debug level to 5. This is a moderately high debug level.) The current version of ZCONTNU.DAT is contained in Appendix C.

(The user can now begin issuing interactive commands. In this session, the data base tables have been set up in a previous session. In particular, the command file ZDEMO.DAT (Appendix C) was used to initialize the data base. The user issues the "PROC" command. Entering "PR" would produce the same result. This command will automatically perform all of the necessary commands through ALLOCATE. This includes the STATESPACE commands, NODES, ACCESS, ARCS and ALLOCATE. The secondary commands are listed in parentheses to the right of the page at the time they are executed by "PROC". The debug output has been included so that the user can see the actual FLAPS outputs.)

```
: < PROC >

 *********************************************
            STATES  "CL"  EXECUTING

                                                 (STAT CLEA TH3D /)
  CLEARING TH3D TO  1.550E-04
                                                 (STAT CLEA CL3D 0.0)
 *********************************************
            STATES  "CL"  EXECUTING

                                                 (STAT CLEA TOBS 0.0)
  CLEARING TOBS TO  0.000E+00


                                          (STAT MASK 2 999)
```

(This is the output produced by the terrain masking algorithm at debug level 5. Each threat in the THRT table will be masked.)

```
 *********************************************
            STATES  "MA"  EXECUTING
   RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=    18.50     S601    41    57    56    72
 WRTMSK -- XOT,YOT,NXT,NYT =  0.79950E+01 0.47998E+02  1600  2400
           DXAMT,DYAMT =  0.50000E-02 0.25000E-02
 WRTMSK -- NXAMT,NYAMT,KSUB,XOA,YOA =    196  249     1 0.11590E+02 0.50303E+02
           DXAMT,DYAMT,XATHMT,YATHMT =  0.50000E-02 0.25000E-02 0.98400E+02
                                        0.12500E+03
 WRTMSK -- NRGMT,NTHMT,DRGMT,DTHMT=   123     94 0.15041E+00 0.66842E-01
 WRTMSK - NEARBY ALTS,HTHMT=  4.530E+02  4.590E+02  4.460E+02  4.530E+02
                              4.533E+02

                                           .
                                           .
                                           .

  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=    9.00     S815    45    53    75    83
 WRTMSK -- XOT,YOT,NXT,NYT =  0.79950E+01 0.47998E+02  1600  2400
```

```
          DXAMT,DYAMT =  0.50000E-02 0.25000E-02
WRTMSK -- NXAMT,NYAMT,KSUB,XOA,YOA =     98  122     1 0.11880E-02 0.51105E-02
          DXAMT,DYAMT,XATHMT,YATHMT =  0.50000E-02 0.25000E-02 0.49680E-02
                                       0.61960E-02
WRTMSK -- NRGMT,NTHMT,DRGMT,DTHMT=    60     46 0.15000E-00 0.13659E-00
WRTMSK - NEARBY ALTS,HTHMT=  1.150E-02  1.120E-02  1.150E-02  1.150E-02
                             1.171E-02
```

(STAT ADD THRT 2 999)

(After performing terrain masking, all of the threats in the THRT table are added to the three dimensional statespace (TH3D).)

```
*********************************************
          STATES  "AD"  EXECUTING  .
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=   18.50    S601    41    57    56    72
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=   18.50    S602    42    58    51    67
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=   18.50    S603    44    60    47    63
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=   18.50    S604    46    62    44    59

                                     .
                                     .
                                     .

  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=    9.00    S812    33    41    57    66
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=    9.00    S813    45    54    57    65
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=    9.00    S814    11    19    62    70
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=    9.00    S815    45    53    75    83
```

(STAT ADD STCH 2 999)

(Next, all of the stochastic threats in the STCH table are added to the three dimensional statespace (TH3D). Note that stochastic threats are not terrain masked.)

```
*********************************************
          STATES  "AD"  EXECUTING
  RMAX,IDSC,ILXT,IUXT,JLXT,JUXT=   18.50    M601    19    45    81    97
 NXSC,NYSC,DXSC,DYSC,XMINSC,YMINSC=  11   8    0.0648    0.0417    10.6759
                                   51.6877
  RMAX,IDSC,ILXT,IUXT,JLXT,JUXT=   18.50    M602     8    40    71    93
 NXSC,NYSC,DXSC,DYSC,XMINSC,YMINSC=  16   7    0.0648    0.0417    10.0138
                                   51.2500
  RMAX,IDSC,ILXT,IUXT,JLXT,JUXT=   18.50    M603     6    37    50    80
 NXSC,NYSC,DXSC,DYSC,XMINSC,YMINSC=  15  15    0.0648    0.0417     9.8792
                                   50.3753

                                     .
                                     .
                                     .

  RMAX,IDSC,ILXT,IUXT,JLXT,JUXT=    9.00    M804    51    67    36    51
```

```
 NXSC,NYSC,DXSC,DYSC,XMINSC,YMINSC=   8   7     0.0648     0.0417    12.5231
                                     49.6325
  RMAX,IDSC,ILXT,IUXT,JLXT,JUXT=    9.00    M805     59     81     19     39
 NXSC,NYSC,DXSC,DYSC,XMINSC,YMINSC=  15  13     0.0648     0.0417    13.0047
                                     48.9170
  RMAX,IDSC,ILXT,IUXT,JLXT,JUXT=    9.00    M806     35     59     45     65
 NXSC,NYSC,DXSC,DYSC,XMINSC,YMINSC=  17  13     0.0648     0.0417    11.4564
                                     50.0000
```

(STAT AOPT 1)

```
 *********************************************
           STATES  "AO"  EXECUTING
 ALTITUDE OPTIMIZATION LEVEL:
< 1>
```

(The user must input the desired altitude level at this time. In this case, the user is building his routes at 60 meters (around 200 feet). The user could have entered "PROC 1" and this prompt would have been skipped.)

(NODES)

```
 ************************************************
                NODES EXECUTING
 TROPSQ - BUILDING TREE NUMBER     1 FOR LLTR ENTRY POINT N001      (    21)
       EXIT POINT N005     (    48)   DISTANCE =  106.40    PA =  0.9960

 TROPSQ - BUILDING TREE NUMBER     2 FOR LLTR ENTRY POINT N031      (    22)
       EXIT POINT N005     (    48)   DISTANCE =  144.44    PA =  0.9946
       EXIT POINT N028     (    49)   DISTANCE =  134.20    PA =  0.9950

 TROPSQ - BUILDING TREE NUMBER     3 FOR LLTR ENTRY POINT S079      (    23)
       EXIT POINT S092     (    50)   DISTANCE =  179.11    PA =  0.9933
       EXIT POINT S133     (    51)   DISTANCE =  261.45    PA =  0.9902

 TROPSQ - BUILDING TREE NUMBER     4 FOR LLTR ENTRY POINT S113      (    24)
       EXIT POINT S133     (    51)   DISTANCE =  208.66    PA =  0.9922
```

(The NODES command outputs the above data while preprocessing the LLTR network.)

(ACCESS)

```
 ********************************************
                ACCESS EXECUTING
```

(The ACCESS command does not output any debug output other than the access executing message.)

(ARCS)

```
*************************************************
           ARCSS EXECUTING


GETARC -- RETRIEVE TRAJECTORIES FROM EXIT TO TGT  TARGET: PANENSKY ( 121)
   GETARC -- TO EXIT  N005      (   48) DIST,PS =   247.1  0.67258
   GETARC -- TO EXIT  N028      (   49) DIST,PS =   212.4  0.66051
   GETARC -- TO EXIT  S092      (   50) DIST,PS =    93.8  0.68223
   GETARC -- TO EXIT  S133      (   51) DIST,PS =   154.3  0.47759

GETARC -- RETRIEVE TRAJECTORIES FROM TGT  TO EXIT TARGET: PANENSKY ( 121)
   GETARC -- TO EXIT  N005      (   48) DIST,PS =   255.5  0.60524
   GETARC -- TO EXIT  N028      (   49) DIST,PS =   220.8  0.59437
   GETARC -- TO EXIT  S092      (   50) DIST,PS =   104.1  0.61299
   GETARC -- TO EXIT  S133      (   51) DIST,PS =   164.6  0.43072

                                  .
                                  .
                                  .

GETARC -- RETRIEVE TRAJECTORIES FROM EXIT TO TGT  TARGET: PRAGUE   ( 126)
   GETARC -- TO EXIT  N005      (   48) DIST,PS =   258.8  0.65622
   GETARC -- TO EXIT  N028      (   49) DIST,PS =   224.2  0.64443
   GETARC -- TO EXIT  S092      (   50) DIST,PS =   105.6  0.66563
   GETARC -- TO EXIT  S133      (   51) DIST,PS =   166.0  0.46597

GETARC -- RETRIEVE TRAJECTORIES FROM TGT  TO EXIT TARGET: PRAGUE   ( 126)
   GETARC -- TO EXIT  N005      (   48) DIST,PS =   265.4  0.58081
   GETARC -- TO EXIT  N028      (   49) DIST,PS =   230.7  0.57038
   GETARC -- TO EXIT  S092      (   50) DIST,PS =   114.0  0.58825
   GETARC -- TO EXIT  S133      (   51) DIST,PS =   174.5  0.41333
```

(The ARCS command computes the optimal ingress and egress for every target to all accessible LLTR exit points. A briefer debug output will be produced under debug level 4.)

(ROUTES)

```
*******************************************
               ROUTES EXECUTING

        6 ROUTES CREATED TO TARGET PANENSKY
        6 ROUTES CREATED TO TARGET ZOLLSCHN
        6 ROUTES CREATED TO TARGET PRESCHEN
        6 ROUTES CREATED TO TARGET CASLAV
        7 ROUTES CREATED TO TARGET LEIPZIG
        7 ROUTES CREATED TO TARGET PRAGUE

     ROUTINE ROUTES FINISHED.
     A TOTAL OF     38 ROUTES ASSEMBLED TO
```

A TOTAL OF 6 TARGETS. RESULTS
APPEAR IN ARRAY ROUT

(The ROUTES command constructs the optimal routes from each staging base to each accessible target. Note that every target is accessible to many staging bases.)

(ALLOCATE)

```
*******************************************
          ALLOC EXECUTING

 ALLOCATION COMPLETED FOR     6 TARGETS.
 RESULTS APPEAR IN TARGET STATUS ARRAY : TGUS
```

(The weapons allocation algorithm has allocated weapons to all 6 of the targets. Had there not been enough aircraft available to attack all of the targets, weapons would have been allocated to the high priority targets first. In that case, only the lowest priority targets would not have been allocated attack aircraft.)

```
CPUTIM,WALLTIM,PAGEFLTS=  1138.670  4087.723  6592.000
```

(It has taken 1138 and 4087 seconds of CPU and wall clock time respectively, to execute PROC. Most of this time is taken up by the STAT MASK, STAT ADD, and ARCS commands. Because so much time has gone into building this set of files, the user next issues a SAVE command. This will protect the work he has done so far. It will also open a new log file.)

```
: < SAVE >

 FLAPS  --  DATE =  1-JAN-86      TIME = 12:08:13
```

(The date and time are always reissued after a SAVE command.)

```
: < HE ON >

          CPUTIM,WALLTIM,PAGEFLTS=     0.010     0.012     1.000
```

(Here, the user has turned on the HELP option. This command, like many, takes a very short amount of time to run.)

```
: < SH ALGP 2 >

 CRSHOW -- RECORD      2    IDWORD=ALGP
          ID  =     ALGP
          DELE= 2.5000E+00
          DELN= 2.5000E+00
          XMIN= 9.0000E+00
          XMAX= 1.6000E+01
          YMIN= 4.8000E+01
```

```
YMAX= 5.2000E-01
NALT=           3
NDIR=           8
IDUM=           2
IDVE=     F-4
ARMX= 5.0000E-06
FLAM= 1.5000E-04
ALTS= 6.0100E-01 1.5240E-02 3.0480E-02 1.0000E-03
      0.0000E-00
XSCL=-2.0000E+00
XSCU= 1.6001E-01
YSCL= 4.8000E-01
YSCU= 5.3000E-01
PCAP= 0.0000E-00 0.0000E+00 0.0000E+00 0.0000E+00
      0.0000E-00
IDC =     85/11/22 16:43
IDM =     85/12/27 11:02

CPUTIM,WALLTIM,PAGEFLTS=     0.140     1.168     8.000
```

(The Algorithm Parameters Table defines the scenario. Note the definition of the scenario and the statespace.)

```
: < CHAN CURR 2 IDEV PTX / >

        CPUTIM,WALLTIM,PAGEFLTS=     0.160     0.949     8.000
```

(The graphic displays normally appear on the Tektronix 4115B terminal. For the purposes of this User's Manual, we have changed the graphical device to the Printronix Printer/Plotter.)

```
: < DI B L / >

        CPUTIM,WALLTIM,PAGEFLTS=     8.000    14.777   274.000
```

(Here the user has displayed the scenario. The "BORDERS" option automatically displays the political borders. The L option draws the longitude - latitude grid. The resulting graphic display is shown in Figure V-1. The user must hit a carriage return to get the : prompt.)

```
: < DI B- M / >

        CPUTIM,WALLTIM,PAGEFLTS=     6.630    10.457    85.000
```

(The user has turned off the border option and turned on the mission option. The resulting display is shown in Figure V-2. Note that the mission option includes the borders, and the staging bases, LLTR's, and targets. These are refered to as the nodes.)

```
: < DI B AR / FAIRFORD >

        CPUTIM,WALLTIM,PAGEFLTS=     9.470    12.902    30.000
```

(Here the user has displayed the "ARCS" around the node FAIRFORD. FAIRFORD is a staging base and so the ARCS show the paths through the current LLTR network, from FAIRFORD to the LLTR exit points. The plot is shown in Figure V-3.)

: < DI SC ST >

CPUTIM,WALLTIM,PAGEFLTS= 0.050 0.129 0.000

(This command rescales the display to include only the statespace. No plot is generated.)

: < DI P / >

CPUTIM,WALLTIM,PAGEFLTS= 0.053 0.145 0.000

(This command purges the current options (M, AR, L). The result is a clear screen.)

: < DI M L D / STAT D 7 >

CPUTIM,WALLTIM,PAGEFLTS= 15.920 41.949 58.000

(This command displays the mission, longitude-latitude grid, and danger contours for the statespace, using the default danger contour levels. The program will prompt the user for the suboptions if he is not sure what they should be. Danger from direction 7 (east) was selected. The plot is shown in Figure V-4.)

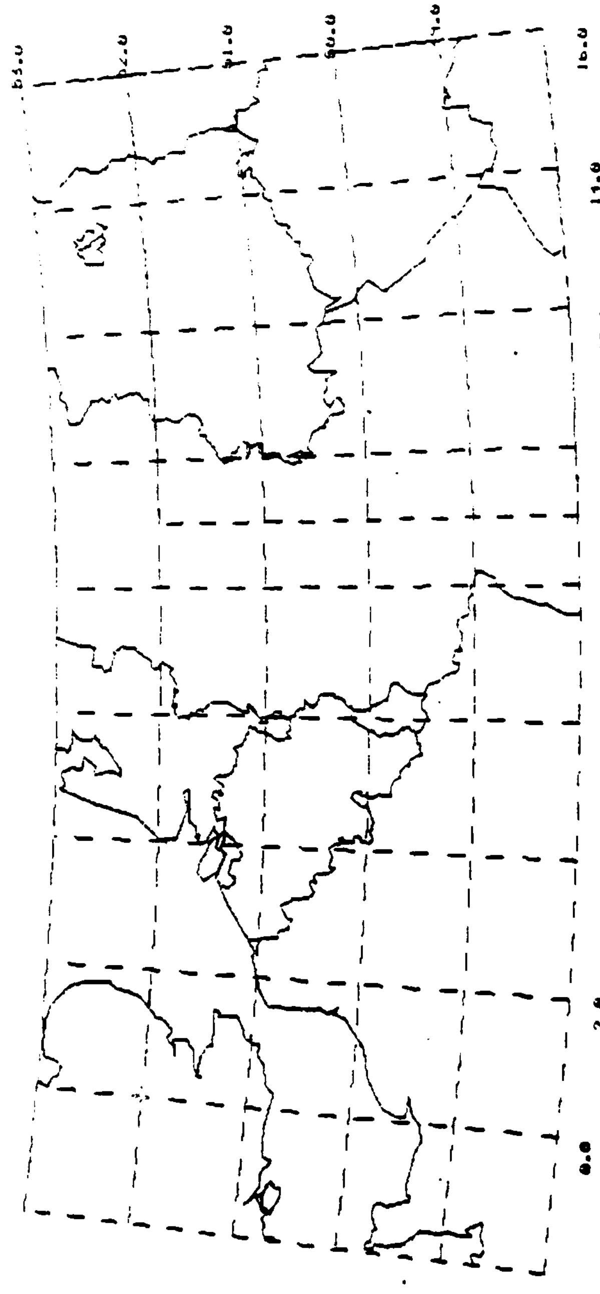


Figure V-1

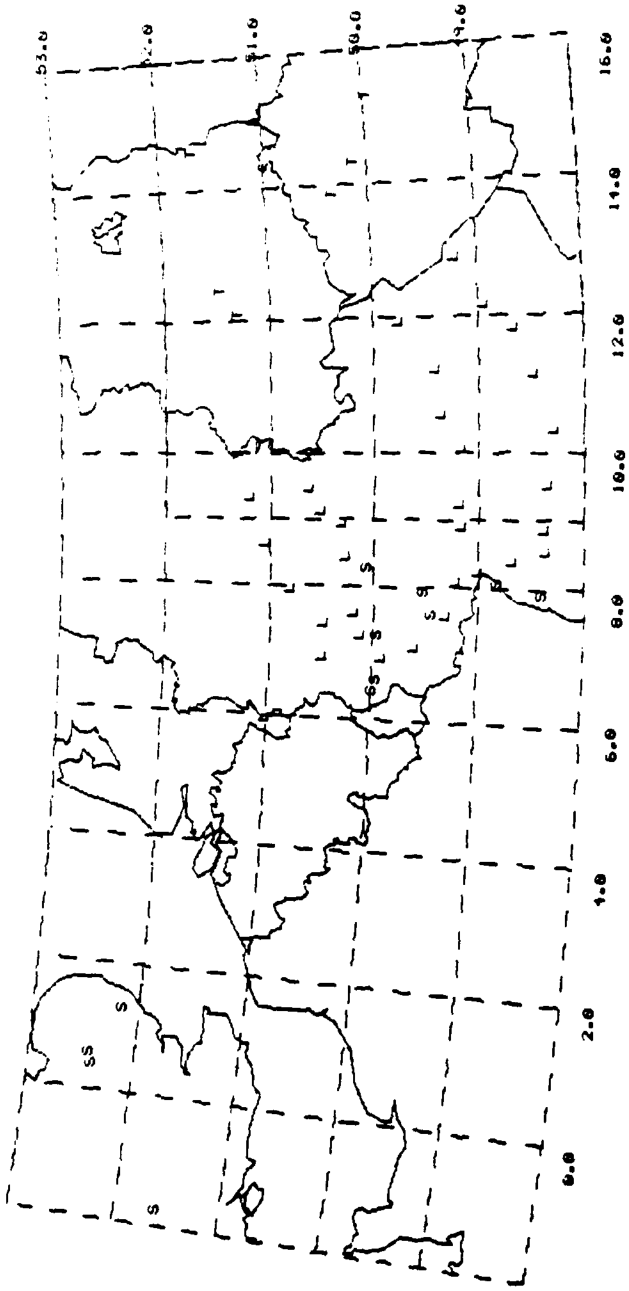


Figure V-2

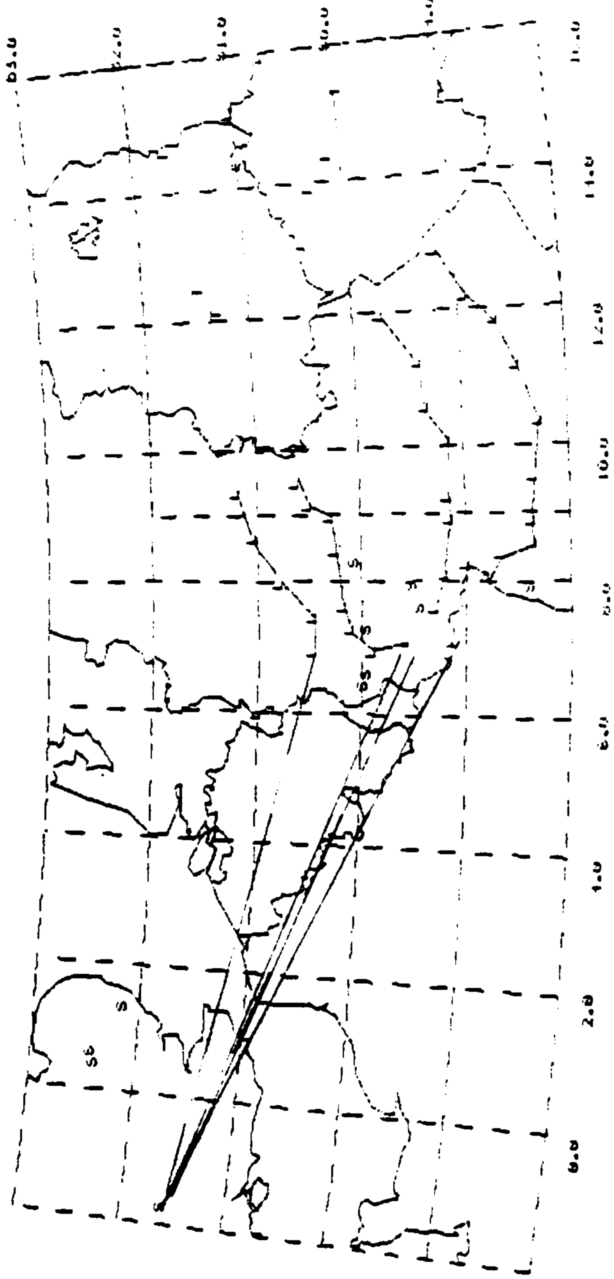


Figure V-3

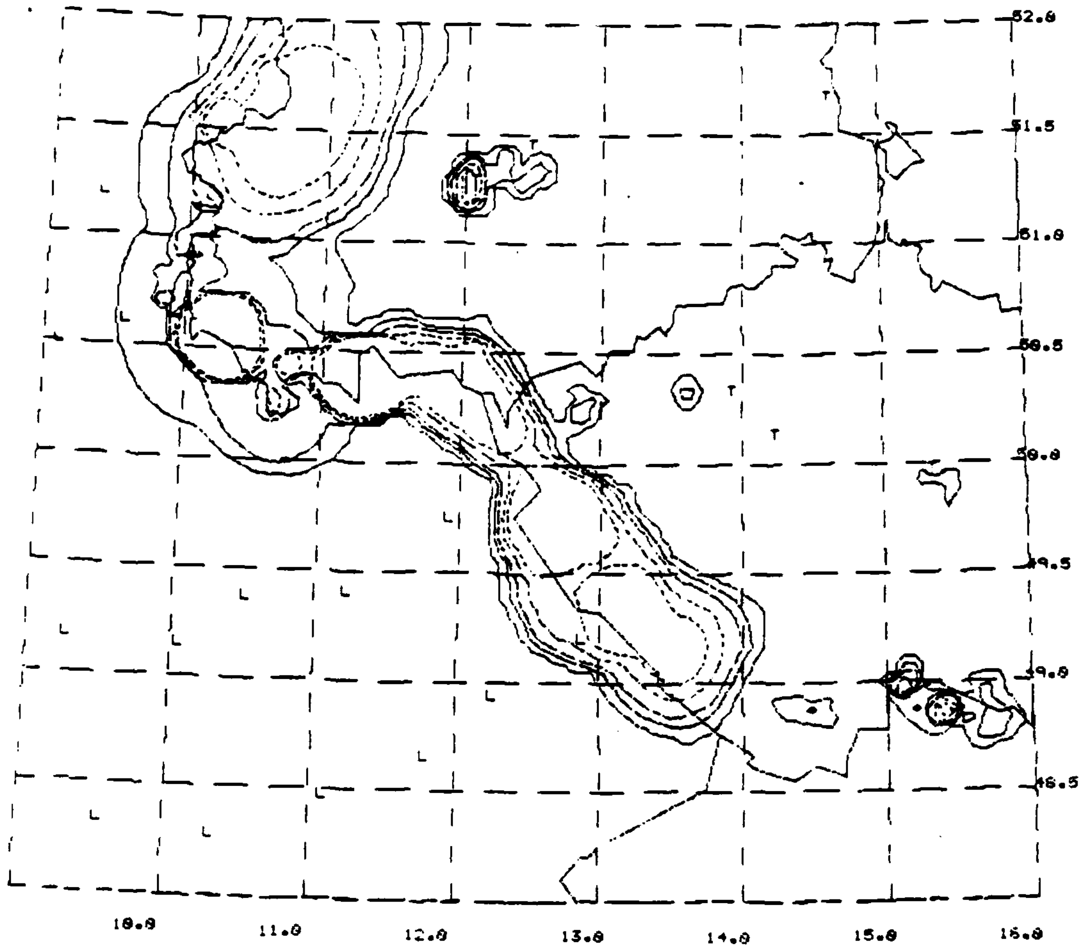


Figure V-4

: < DI D / TH3D D 7 1 >

CPUTIM,WALLTIM,PAGEFLTS= 23.490 70.473 0.000

(This command displays the danger contours from the TH3D file. Level 1 (60 meters) and direction 7 (east) were selected. Entering the "D" option a second time will cancel the previous danger contour settings. The user will be prompted for the new settings. Because the current altitude level is 1 (from STAT AOPT), the STAT file is the same as TH3D level 1. The last display was made using STAT in direction 7, so this plot is exactly the same as the last one! Refer to Figure V-4, again.)

: < DI D / TH3D D 4 1 >

CPUTIM,WALLTIM,PAGEFLTS= 23.610 90.211 0.000

: < DI D / TH3D D 7 2 >

CPUTIM,WALLTIM,PAGEFLTS= 23.250 82.449 0.000

: < DI D / TH3D D 7 3 >

CPUTIM,WALLTIM,PAGEFLTS= 22.420 73.520 0.000

(These commands result in three different danger plots of TH3D. They are shown in Figures V-5, V-6, and V-7. Figure V-5 is at level 1 (60 m), direction 4 (south). Notice how it is slightly different from the danger at the same altitude but at direction east (Figure V-4). Figure V-6 is at atlitude level 2 (150 m), direction 7 (east). Notice how the threat coverage has spread. Figure V-7 is at level 3 (300 m), direction 7. Again the threat coverage has spread.)

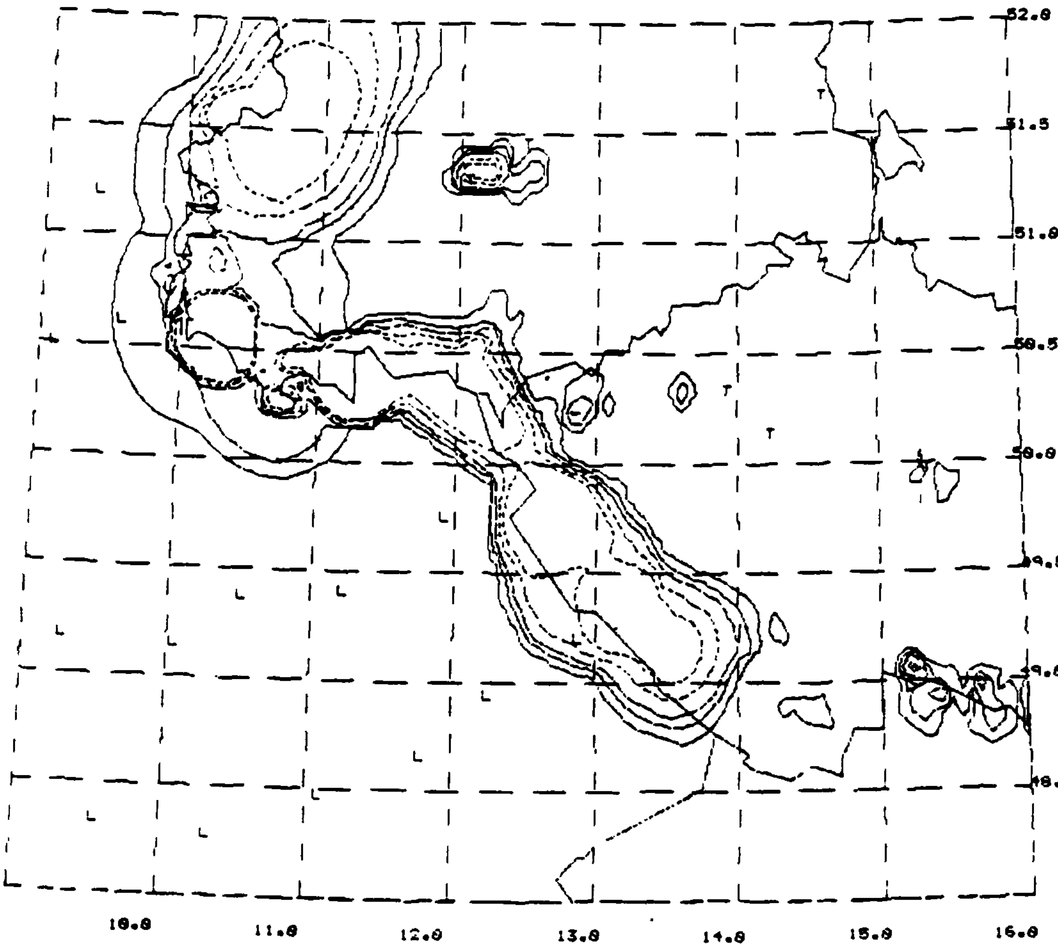


Figure V-5

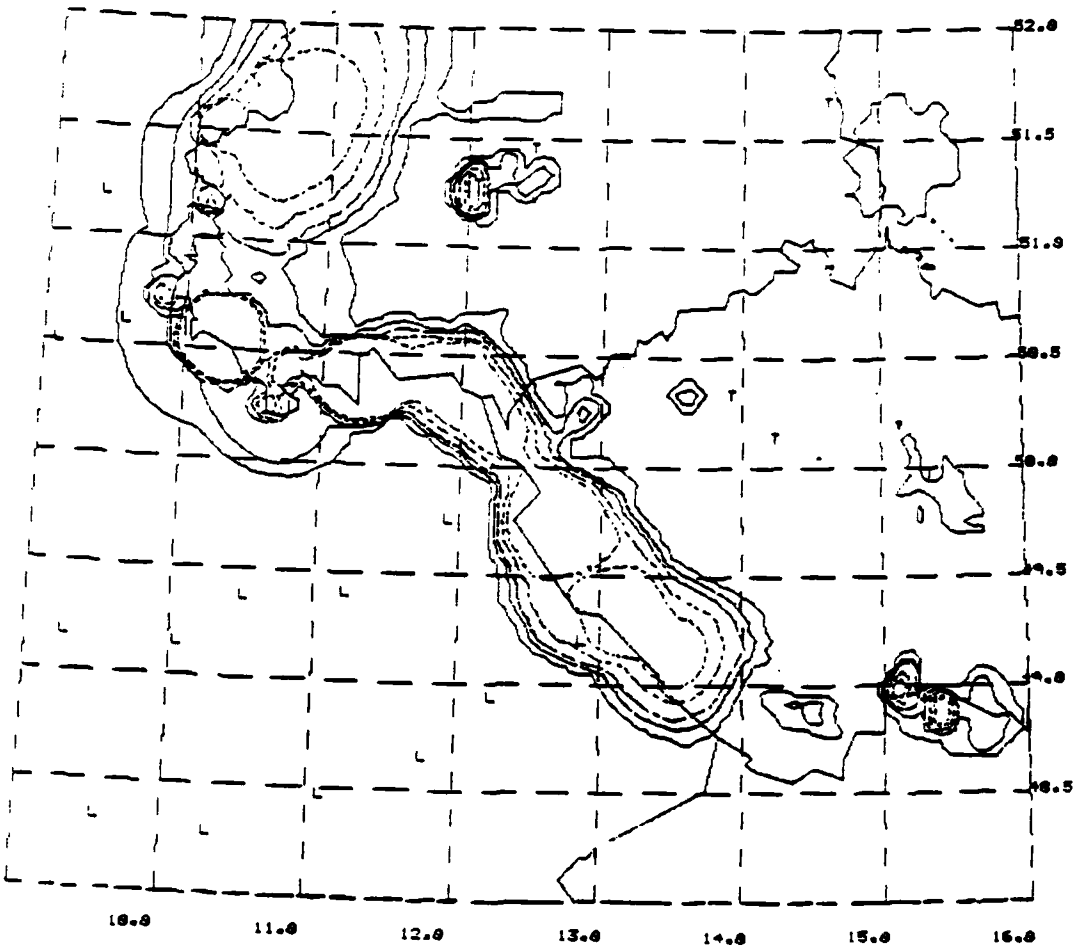


Figure V-6

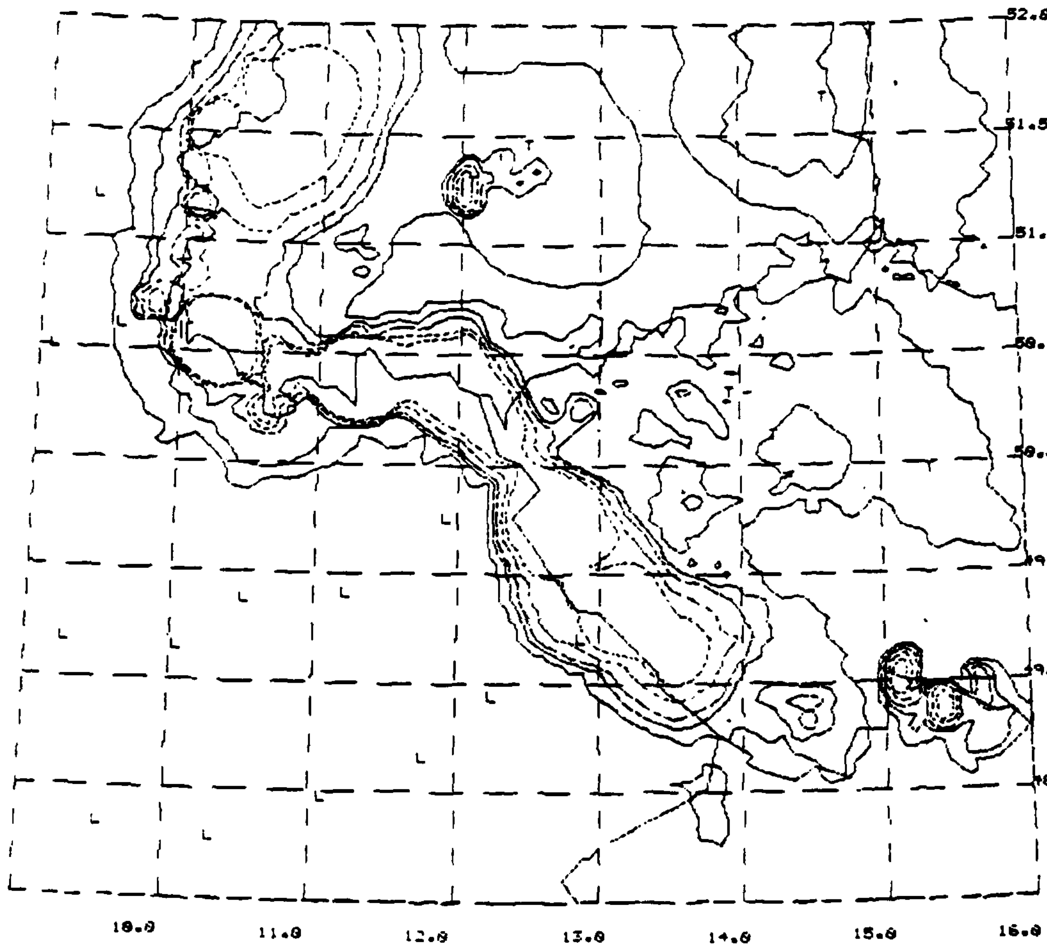


Figure V-7

(Now the SHOW command will be demonstrated. First, consider the arrays generated by the NODES command. These are NLIS, NPOS, ITRC, and TRPE.)

: < SHOW NLIS >

WRLIS -- ARRAY NLIS - LIST OF ID NAMES

INDEX	ID NAME
1	FAIRFORD
2	LAKENHTH
3	MILDENHA
4	BENTWATE
5	BITBURG
6	SPANGDAH
7	HAHN
8	RAMSTEIN
9	SEMBACH
10	LAHR
11	SOLLING
12	WIESBADN
21	N001
22	N031
23	S079
24	S113
25	N002
26	N003
27	N004
28	N023
29	N024
30	N025
31	N026
32	N027
33	N030
34	S080
35	S081
36	S082
37	S085
38	S086
39	S091
40	S112
41	S126
42	S127
43	S128
44	S129
45	S130
46	S131
47	S132
48	N005
49	N028
50	S092
51	S133
121	PANENSKY

```
122     ZOLLSCHN
123     PRESCHEN
124     CASLAV
125     LEIPZIG
126     PRAGUE

   CPUTIM,WALLTIM,PAGEFLTS=      0.220      1.480      3.000

: < SHOW NPOS >
```

WRPOS -- ARRAYS NPOS

ID NAME	INDEX	LONG	LAT
FAIRFORD	1	-1.75	51.58
LAKENHTH	2	0.58	52.40
MILDENHA	3	0.50	52.37
BENTWATE	4	1.42	52.13
BITBURG	5	6.53	49.97
SPANGDAH	6	6.67	49.93
HAHN	7	7.25	49.93
RAMSTEIN	8	7.57	49.43
SEMBACH	9	7.88	49.50
LAHR	10	7.93	48.37
SOLLING	11	8.08	48.78
WIESBADN	12	8.33	50.05
N001	21	6.94	50.45
N031	22	7.07	49.59
S079	23	7.65	49.29
S113	24	8.34	48.66
N002	25	7.44	50.45
N003	26	7.99	50.78
N004	27	8.59	51.03
N023	28	7.21	50.09
N024	29	7.65	50.18
N025	30	8.46	50.24
N026	31	8.97	50.29
N027	32	9.12	50.50
N030	33	6.95	49.89
S080	34	8.11	49.20
S081	35	8.91	49.14
S082	36	9.31	49.16
S085	37	10.07	49.14
S086	38	10.51	49.36
S091	39	11.20	49.40
S112	40	8.25	48.98
S126	41	8.52	48.35
S127	42	8.98	48.36
S128	43	9.55	48.32
S129	44	10.36	48.27
S130	45	11.13	48.46
S131	46	11.79	48.65
S132	47	12.22	48.93

N005	48	9.38	51.19
N028	49	9.56	50.60
S092	50	11.91	49.74
S133	51	12.37	49.18
PANENSKY	121	13.93	50.32
ZOLLSCHN	122	12.12	51.27
PRESCHEN	123	14.65	51.65
CASLAV	124	15.38	49.95
LEIPZIG	125	12.45	51.43
PRAGUE	126	14.27	50.12

CPUTIM,WALLTIM,PAGEFLTS= 0.330 2.961 0.000

: < SH ITRC N031 >

WRTREE -- THERE ARE 2 EXITS ACCESSIBLE TO LLTR ENTRY POINT N031 (22)

BRANCH FOR LLTR EXIT N005 (48) DIST = 144.44 PA = 0.9946

1	N031	(22)
2	N030	(33)
3	N023	(28)
4	N002	(25)
5	N003	(26)
6	N004	(27)
8	N005	(48)

BRANCH FOR LLTR EXIT N028 (49) DIST = 134.20 PA = 0.9950

1	N031	(22)
2	N030	(33)
3	N023	(28)
4	N024	(29)
5	N025	(30)
6	N026	(31)
7	N027	(32)
9	N028	(49)

CPUTIM,WALLTIM,PAGEFLTS= 0.090 0.941 0.000

: < SHOW TRPE N031 >

WRTRPE -- THERE ARE 2 EXITS ACCESSIBLE TO LLTR ENTRY POINT N031 (22)

	LLTR EXIT		DISTANCE	PROB OF ARRIVAL
1	N005	(48)	144.44	0.9946
2	N028	(49)	134.20	0.9950

```
CPUTIM,WALLTIM,PAGEFLTS=     0.030     0.340     0.000
```

(These arrays are described in Chapter IV. The indices listed in NLIS and LPOS are quite useful. For many FLAPS prompts, where a node name is needed, the user can enter these integer numbers instead of the longer node name.)

(The arrays ITGC, SXPE, and NBOX are created by the ACCESS command. They contain data about the paths through the LLTR network to the targets.)

```
: &lt; SHOW ITGC CASLAV &gt;

 WRACC -- THERE ARE    24 PATHS TO TARGET CASLAV   (  124) IN ARRAY ITGC

         STAGING BASE                 LLTR ENTRY          LLTR EXIT

    1       FAIRFORD (     1)       N001     (    21)      N005     (    48)
    2       FAIRFORD (     1)       N031     (    22)      N028     (    49)
    3       FAIRFORD (     1)       S079     (    23)      S092     (    50)
    4       FAIRFORD (     1)       S113     (    24)      S133     (    51)
    5       LAKENHTH (     2)       N001     (    21)      N005     (    48)
    6       LAKENHTH (     2)       N031     (    22)      N028     (    49)
    7       LAKENHTH (     2)       S079     (    23)      S092     (    50)
    8       LAKENHTH (     2)       S113     (    24)      S133     (    51)
    9       MILDENHA (     3)       N001     (    21)      N005     (    48)
   10       MILDENHA (     3)       N031     (    22)      N028     (    49)
   11       MILDENHA (     3)       S079     (    23)      S092     (    50)
   12       MILDENHA (     3)       S113     (    24)      S133     (    51)
   13       RAMSTEIN (     8)       N031     (    22)      N005     (    48)
   14       RAMSTEIN (     8)       N031     (    22)      N028     (    49)
   15       RAMSTEIN (     8)       S079     (    23)      S092     (    50)
   16       RAMSTEIN (     8)       S113     (    24)      S133     (    51)
   17       SEMBACH  (     9)       N001     (    21)      N005     (    48)
   18       SEMBACH  (     9)       N031     (    22)      N028     (    49)
   19       SEMBACH  (     9)       S079     (    23)      S092     (    50)
   20       SEMBACH  (     9)       S113     (    24)      S133     (    51)
   21       LAHR     (    10)       N031     (    22)      N005     (    48)
   22       LAHR     (    10)       N031     (    22)      N028     (    49)
   23       LAHR     (    10)       S079     (    23)      S092     (    50)
   24       LAHR     (    10)       S113     (    24)      S133     (    51)

         CPUTIM,WALLTIM,PAGEFLTS=     0.190     2.340     0.000

: &lt; SH SXPE PRESCHEN &gt;

 WRSXPE -- THERE ARE    24 PATHS TO TARGET PRESCHEN (  123)


     PATHS FOR STAGING BASE FAIRFORD (     1)

              LLTR EXIT                DISTANCE          PROB OF ARRIVAL
```

	LLTR EXIT		DISTANCE TO EXIT	PROB OF ARRIVAL AT EXIT
1	N005	(48)	441.12	0.9836
2	N028	(49)	490.58	0.9817
3	S092	(50)	563.65	0.9790
4	S133	(51)	634.06	0.9764

PATHS FOR STAGING BASE LAKENHTH (2)

	LLTR EXIT		DISTANCE TO EXIT	PROB OF ARRIVAL AT EXIT
5	N005	(48)	371.29	0.9861
6	N028	(49)	431.36	0.9839
7	S092	(50)	505.42	0.9812
8	S133	(51)	579.59	0.9784

PATHS FOR STAGING BASE MILDENHA (3)

	LLTR EXIT		DISTANCE TO EXIT	PROB OF ARRIVAL AT EXIT
9	N005	(48)	373.30	0.9861
10	N028	(49)	432.91	0.9839
11	S092	(50)	506.96	0.9811
12	S133	(51)	581.01	0.9784

PATHS FOR STAGING BASE RAMSTEIN (8)

	LLTR EXIT		DISTANCE TO EXIT	PROB OF ARRIVAL AT EXIT
13	N005	(48)	165.97	0.9938
14	N028	(49)	155.72	0.9942
15	S092	(50)	188.46	0.9929
16	S133	(51)	264.10	0.9901

PATHS FOR STAGING BASE SEMBACH (9)

	LLTR EXIT		DISTANCE TO EXIT	PROB OF ARRIVAL. AT EXIT
17	N005	(48)	173.99	0.9935
18	N028	(49)	166.27	0.9938
19	S092	(50)	194.66	0.9927
20	S133	(51)	262.18	0.9902

PATHS FOR STAGING BASE LAHR (10)

LLTR	EXIT		DISTANCE TO EXIT	PROB OF ARRIVAL AT EXIT
21	N005	(48)	225.44	0.9916
22	N028	(49)	215.19	0.9919
23	S092	(50)	235.47	0.9912
24	S133	(51)	232.43	0.9913

CPUTIM,WALLTIM,PAGEFLTS= 0.270 3.383 0.000

: < SHOW NBOX >

WRBOX -- ARRAY NBOX -- DPA BOX LIMITS

ID	INDEX	MIN LONG	MAX LONG	MIN LAT	MAX LAT
PANENSKY	121	9.2	14.1	49.0	51.3
ZOLLSCHN	122	9.2	13.0	49.0	51.4
PRESCHEN	123	9.2	14.8	49.0	51.8
CASLAV	124	9.2	15.5	49.0	51.3
LEIPZIG	125	9.2	13.0	49.0	51.6
PRAGUE	126	9.2	14.4	49.0	51.3

CPUTIM,WALLTIM,PAGEFLTS= 0.090 0.617 2.000

(These arrays are also described in Chapter IV.)

(Now consider the two arrays generated by the ARCS command. These are ARPE and ARCS. The arc performance data below is for the ingress and egress routes from targets LEIPZIG and PRAGUE.)

: < SH ARPE LEIPZIG >

WRPERF -- ARRAY ARPE -- ARC PERFORMANCES FROM LEIPZIG (125)

			INGRESS		EGRESS	
	ID	INDEX	DIST (NM)	PS	DIST (NM)	PS
1	N005	48	317.11	0.6334	305.32	0.5875
2	N028	49	282.44	0.6220	270.65	0.5769
3	S092	50	163.82	0.6425	154.93	0.5825
4	S133	51	224.57	0.4498	214.65	0.4181

CPUTIM,WALLTIM,PAGEFLTS= 0.050 0.539 0.000

: < SH ARPE PRAGUE >

WRPERF -- ARRAY ARPE -- ARC PERFORMANCES FROM PRAGUE (126)

INGRESS EGRESS

	ID	INDEX	DIST (NM)	PS	DIST (NM)	PS
1	N005	48	258.34	0.6562	265.42	0.5808
2	N028	49	224.17	0.6444	230.75	0.5704
3	S092	50	105.55	0.6656	114.01	0.5882
4	S133	51	166.03	0.4660	174.48	0.4133

CPUTIM,WALLTIM,PAGEFLTS= 0.060 0.527 0.000

(The actual waypoints for the arcs may be shown by entering "SHOW ARCS". The user must enter a target name and an LLTR exit point name. The LLTR exit point must be accessible to the target. The list of accessible LLTR exit points for a target may be found in the ARPE and ITGC arrays. Below are the optimal ingress and egress arcs from LLTR exit point S092 to target CASLAV.)

: < SH ARCS CASLAV S092 >

WRARCS - ARRAY ARCS - 12 POINT INGRESS ARC FROM CASLAV (124) TO S092

TIME	LONGITUDE	LATITUDE	ALTITUDE	NODE
0.000	11.914	49.738	60.100	S092
0.057	12.436	50.042	60.100	
0.125	13.278	50.042	60.100	
0.209	14.315	49.958	60.100	
0.216	14.380	49.917	60.100	
0.227	14.510	49.917	60.100	
0.234	14.575	49.875	60.100	
0.239	14.639	49.875	60.100	
0.251	14.769	49.917	60.100	
0.266	14.899	50.000	60.100	
0.292	15.223	50.000	60.100	
0.306	15.383	49.950	60.100	CASLAV

WRARCS - ARRAY ARCS - 18 POINT EGRESS ARC FROM CASLAV (124) TO S092

TIME	LONGITUDE	LATITUDE	ALTITUDE	NODE
0.000	15.383	49.950	60.100	CASLAV
0.003	15.417	49.958	60.100	
0.010	15.482	50.000	60.100	
0.026	15.482	50.125	60.100	
0.041	15.353	50.208	60.100	
0.056	15.158	50.208	60.100	
0.064	15.093	50.167	60.100	
0.069	15.028	50.167	60.100	
0.076	14.964	50.125	60.100	
0.092	14.769	50.125	60.100	
0.114	14.575	50.000	60.100	
0.140	14.251	50.000	60.100	
0.148	14.186	49.958	60.100	
0.221	13.278	50.042	60.100	

```
0.274     12.630    50.042    60.100
0.281     12.565    50.000    60.100
0.297     12.371    50.000    60.100
0.346     11.914    49.738    60.100     S092

     CPUTIM,WALLTIM,PAGEFLTS=     0.280     2.180    30.000
```

(The data in the ARCS is often interesting to display. Again the AR option is selected, and the target name or index is given.)

```
: < DI P / >                    (purge the display option list)

     CPUTIM,WALLTIM,PAGEFLTS=     0.053     0.145     0.000

: < DI SC SC / >        (scale for the scenario space)

     CPUTIM,WALLTIM,PAGEFLTS=     0.053     0.145     0.000

: < DI M AR / ZOLLSCHN > (display arcs for target ZOLLSCHN)

     CPUTIM,WALLTIM,PAGEFLTS=     4.500     5.172   261.000
```

(See Figure V-8.)

(The ROUTES command creates the ROUT array. Recall that there are many routes for target ZOLLSCHN. All of these routes are shown below.)

```
: < SHOW ROUTES ZOLLSCHN >
```

T A R G E T : ZOLLSCHN   PD ACHIEVED : 0.9900

	STAGING BASE	LLTR ENTRY	LLTR EXIT	DIST (NM)	PS	A/C	WEAP TYPE	EXP LOSSES
IN	FAIRFORD	N001	N005	564.0	0.194			
EG	FAIRFORD	N001	N005	559.5	0.321			
TOTAL				1123.5	0.062	4 F111	MARK-84	3.752

T A R G E T : ZOLLSCHN   PD ACHIEVED : 0.9900

	STAGING BASE	LLTR ENTRY	LLTR EXIT	DIST (NM)	PS	A/C	WEAP TYPE	EXP LOSSES
IN	LAKENHTH	N001	N005	494.2	0.194			
EG	LAKENHTH	N001	N005	489.7	0.321			
TOTAL				983.9	0.062	4 F111	MARK-84	3.750

T A R G E T : ZOLLSCHN   PD ACHIEVED : 0.9900

	STAGING BASE	LLTR ENTRY	LLTR EXIT	DIST (NM)	PS	A/C	WEAP TYPE	EXP LOSSES
IN	MILDENHA	N001	N005	496.2	0.194			
EG	MILDENHA	N001	N005	491.7	0.321			
TOTAL				987.9	0.062	4 F111	MARK-84	3.750

T A R G E T : ZOLLSCHN PD ACHIEVED : 0.9798

	STAGING BASE	LLTR ENTRY	LLTR EXIT	DIST (NM)	PS	A/C	WEAP TYPE	EXP LOSSES
IN	BITBURG	N001	N005	262.1	0.196			
EG	BITBURG	N001	N005	257.6	0.324			
TOTAL				519.7	0.064	4 F-4	MARK-20	3.746

T A R G E T : ZOLLSCHN PD ACHIEVED : 0.9798

	STAGING BASE	LLTR ENTRY	LLTR EXIT	DIST (NM)	PS	A/C	WEAP TYPE	EXP LOSSES
IN	SPANGDAH	N001	N005	261.9	0.196			
EG	SPANGDAH	N001	N005	257.4	0.324			
TOTAL				519.3	0.064	4 F-4	MARK-20	3.746

T A R G E T : ZOLLSCHN PD ACHIEVED : 0.9798

	STAGING BASE	LLTR ENTRY	LLTR EXIT	DIST (NM)	PS	A/C	WEAP TYPE	EXP LOSSES
IN	RAMSTEIN	N031	N005	288.9	0.196			
EG	RAMSTEIN	N031	N005	284.4	0.324			
TOTAL				573.2	0.063	6 F-16	MARK-20	5.620

T A R G E T : ZOLLSCHN PD ACHIEVED : 0.9798

	STAGING BASE	LLTR ENTRY	LLTR EXIT	DIST (NM)	PS	A/C	WEAP TYPE	EXP LOSSES
IN	SEMBACH	N001	N005	296.9	0.196			
EG	SEMBACH	N001	N005	292.4	0.324			
TOTAL				589.3	0.063	6 F-16	MARK-20	5.620

T A R G E T : ZOLLSCHN PD ACHIEVED : 0.9798

	STAGING BASE	LLTR ENTRY	LLTR EXIT	DIST (NM)	PS	A/C	WEAP TYPE	EXP LOSSES
IN	LAHR	N031	N005	348.3	0.195			
EG	LAHR	N031	N005	343.8	0.323			
TOTAL				692.2	0.063	6 F-16	MARK-20	5.621

T A R G E T : ZOLLSCHN PD ACHIEVED : 0.9798

	STAGING BASE	LLTR ENTRY	LLTR EXIT	DIST (NM)	PS	A/C	WEAP TYPE	EXP LOSSES
IN	WIESBADN	N001	N005	287.8	0.196			
EG	WIESBADN	N001	N005	283.3	0.324			
TOTAL				571.1	0.063	4 F-4	MARK-20	3.746

CPUTIM,WALLTIM,PAGEFLTS= 0.310 4.488 0.000

(Any time after the ROUTES command has been run, the routes may be selected into the SPED table and displayed. Here the route from staging

base FAIRFORD to target ZOLLSCHN is selected.)

: < SELECT / ZOLLSCHN FAIRFORD FAIR.ZOLLSCH >

SPWRIT -- SELECTED ROUTE WRITTEN TO SPED: ID FAIR.ZOLLSCH RECORD 2

CPUTIM,WALLTIM,PAGEFLTS= 0.290 0.840 55.000

(In this case, the user entered his own ID name for the SPED record. The program would have generated a name automatically, if the user had entered a "/" instead of "FAIR.ZOLLSCH". The route may now be displayed using the RO option.)

: < DI P / >

CPUTIM,WALLTIM,PAGEFLTS= 0.040 0.121 1.000

: < DI M L RO / FAIR.ZOLLSCH >

CPUTIM,WALLTIM,PAGEFLTS= 6.760 8.102 5.000

(The result is in Figure V-9. Recall that the SPED record can be written out in an easy to interpret form. This is the SHOW PLAN feature. The route FAIR.ZOLLSCH is shown below.)

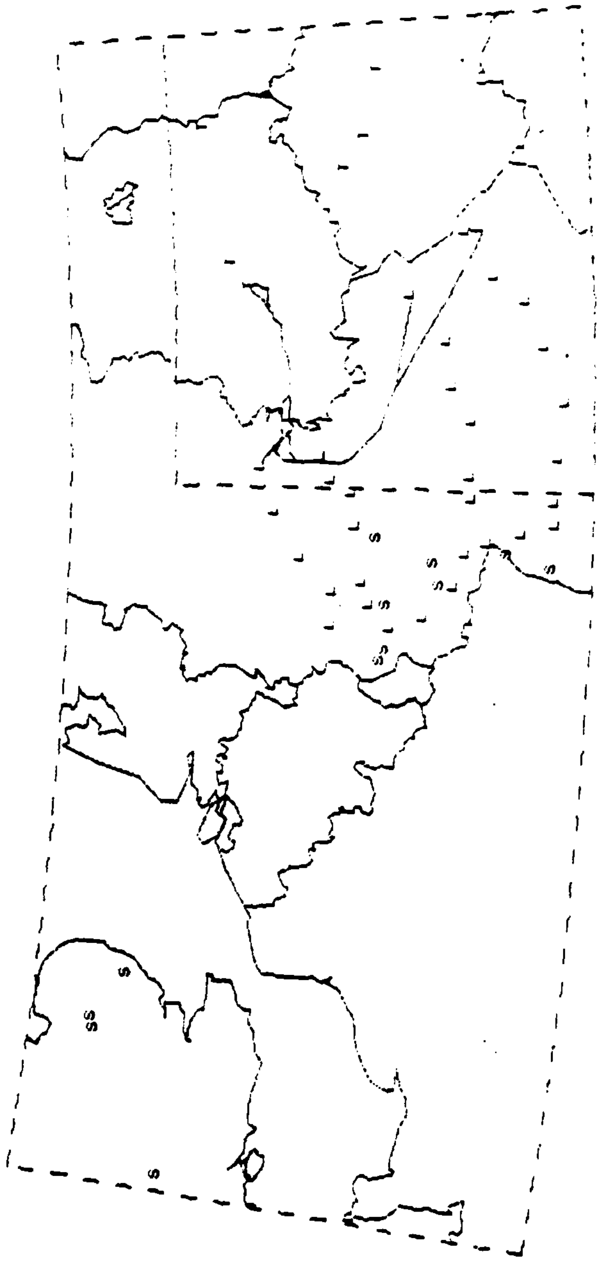


Figure V-8

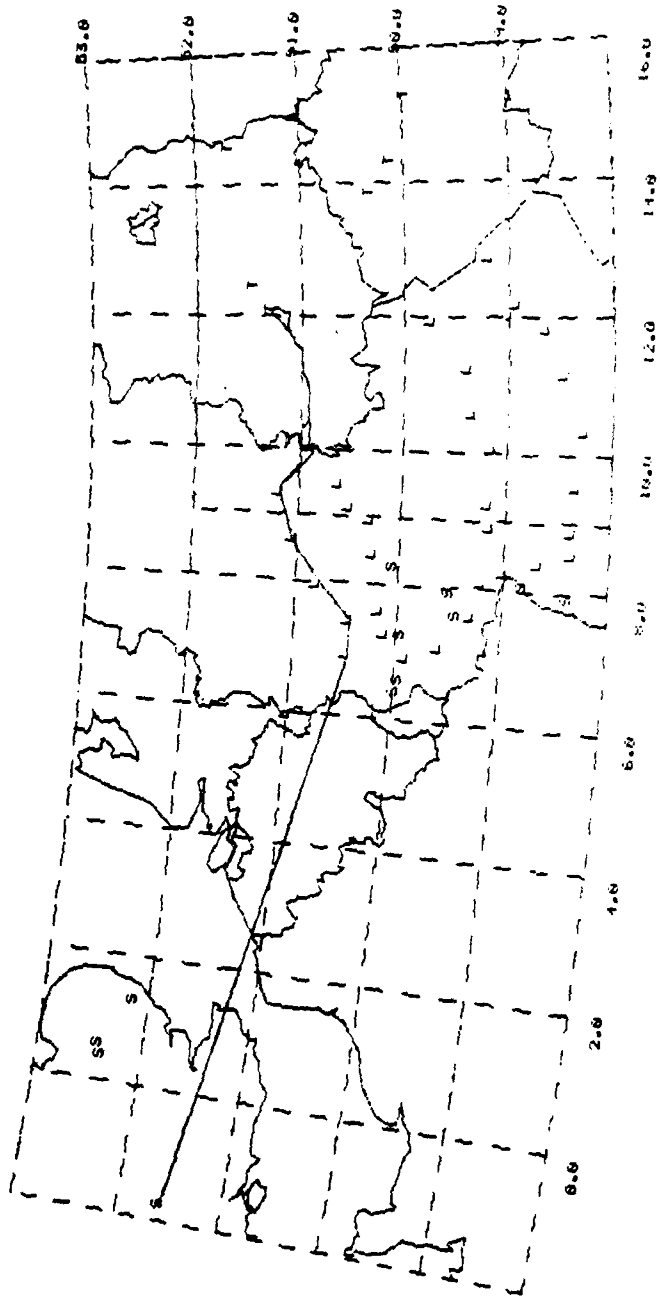


Figure V-9

: < SHOW PLAN FAIR.ZOLLSCH >

WRPLAN - FLIGHT PLAN FOR SORTIE: FAIR.ZOLLSCH

STAGING BASE FAIRFORD (1) TO TARGET ZOLLSCHN (122)
PROB OF SURVIVAL: 0.0621 THREAT PK: 0.9379
FLIGHT DISTANCE: 1123.52 NM
TAKE OFF TIME: 0.0000 TIME ON TARGET: 70.6784 OF WAYPOINTS: 39

TIME (MIN)	LATITUDE (DMS)	LONGITUDE (DMS)	ALTITUDE (FEET)	HEADING (DEG)	NODE ID
0.000	51 34 60	-1 45 00	197.18	101.59	FAIRFORD
41.945	50 26 54	6 56 16	197.18	89.73	N001
44.361	50 26 59	7 26 33	197.18	46.31	N002
47.967	50 46 50	7 59 24	197.18	56.62	N003
51.380	51 01 47	8 35 29	197.18	72.33	N004
55.278	51 11 12	9 22 43	197.18	133.05	N005
58.706	50 52 30	9 54 27	197.18	62.99	
59.396	50 54 60	10 02 14	197.18	90.00	
63.391	50 54 60	10 52 47	197.18	71.21	
64.364	50 57 30	11 04 27	197.18	44.39	
64.803	51 00 00	11 08 21	197.18	90.00	
66.336	51 00 00	11 27 48	197.18	44.34	
67.213	51 04 60	11 35 34	197.18	90.00	
67.519	51 04 60	11 39 28	197.18	44.31	
67.957	51 07 30	11 43 21	197.18	90.00	
69.486	51 07 30	12 02 48	197.18	0.00	
69.800	51 09 60	12 02 48	197.18	44.26	
70.237	51 12 30	12 06 41	197.18	0.00	
70.550	51 15 00	12 06 41	197.18	11.13	
70.678	51 16 00	12 07 00	197.18	299.67	ZOLLSCHN
71.058	51 17 30	12 02 48	197.18	224.29	
72.370	51 09 60	11 51 08	197.18	270.00	
72.675	51 09 60	11 47 14	197.18	224.34	
73.551	51 04 60	11 39 28	197.18	270.00	
73.857	51 04 60	11 35 34	197.18	224.39	
74.734	51 00 00	11 27 48	197.18	270.00	
76.267	51 00 00	11 08 21	197.18	224.42	
76.706	50 57 30	11 04 27	197.18	251.23	
77.679	50 54 60	10 52 47	197.18	270.00	
79.830	50 54 60	10 25 34	197.18	315.61	
80.707	51 00 00	10 17 47	197.18	270.00	
83.161	51 00 00	9 46 40	197.18	304.30	
84.274	51 04 60	9 35 00	197.18	308.86	
85.514	51 11 12	9 22 43	197.18	252.39	N005
89.413	51 01 47	8 35 29	197.18	236.77	N004
92.825	50 46 50	7 59 24	197.18	226.51	N003
96.432	50 26 59	7 26 33	197.18	269.73	N002
98.848	50 26 54	6 56 16	197.18	281.87	N001
140.793	51 34 60	-1 45 00	197.18	281.87	FAIRFORD

CPUTIM,WALLTIM,PAGEFLTS= 0.330 3.340 0.000

(The result of ALLOCATE is the TGUS array. This is the data that would go into an Air Tasking Order. For the allocation generated in this run, the TGUS array is shown below.)

: < SHOW TGUS >

TARGET	STAGING BASE	AIRCRAFT ALLOCATED	WEAPON TYPE	PD ACHIEVED	ROUTE PS	ROUTE DIST (NM)
--------	--------	--------	----	------	------	-------
PANENSKY	LAKENHTH	2 F111	CBU-38	0.878	0.11	1131.0
ZOLLSCHN	FAIRFORD	4 F111	MARK-84	0.990	0.06	1123.5
PRESCHEN	RAMSTEIN	2 F-16	MARK-20	0.900	0.11	800.9
CASLAV	MILDENHA	2 F111	MARK-20	0.961	0.10	1273.5
LEIPZIG	HAHN	4 F-16	AGM-65	0.999	0.10	566.8
PRAGUE	RAMSTEIN	4 F-16	AGM-65	0.999	0.11	758.4

CPUTIM,WALLTIM,PAGEFLTS= 0.090 0.820 0.000

(Notice that weapons were available for all targets. The current allocation can be displayed, again using the SELECT command. First the old records in the SPED file are deleted. Then the current allocation is loaded into SPED.)

: < DE SPED 2 999 >

CPUTIM,WALLTIM,PAGEFLTS= 0.460 2.020 6.000

: < SELECT ALL >

```
SPWRIT -- SELECTED ROUTE WRITTEN TO SPED: ID HAHNPRAG01  RECORD  2
SPWRIT -- SELECTED ROUTE WRITTEN TO SPED: ID RAMSLEIP01  RECORD  3
SPWRIT -- SELECTED ROUTE WRITTEN TO SPED: ID MILDCASL01  RECORD  4
SPWRIT -- SELECTED ROUTE WRITTEN TO SPED: ID RAMSPRES01  RECORD  5
SPWRIT -- SELECTED ROUTE WRITTEN TO SPED: ID FAIRZOLL01  RECORD  6
SPWRIT -- SELECTED ROUTE WRITTEN TO SPED: ID LAKEPANE01  RECORD  7
```

CPUTIM,WALLTIM,PAGEFLTS= 3.510 10.320 23.000

(The allocation may be displayed as follows. The result is in Figure V-10.)

: < DI RO / 2 7 >

CPUTIM,WALLTIM,PAGEFLTS= 10.800 12.961 0.000

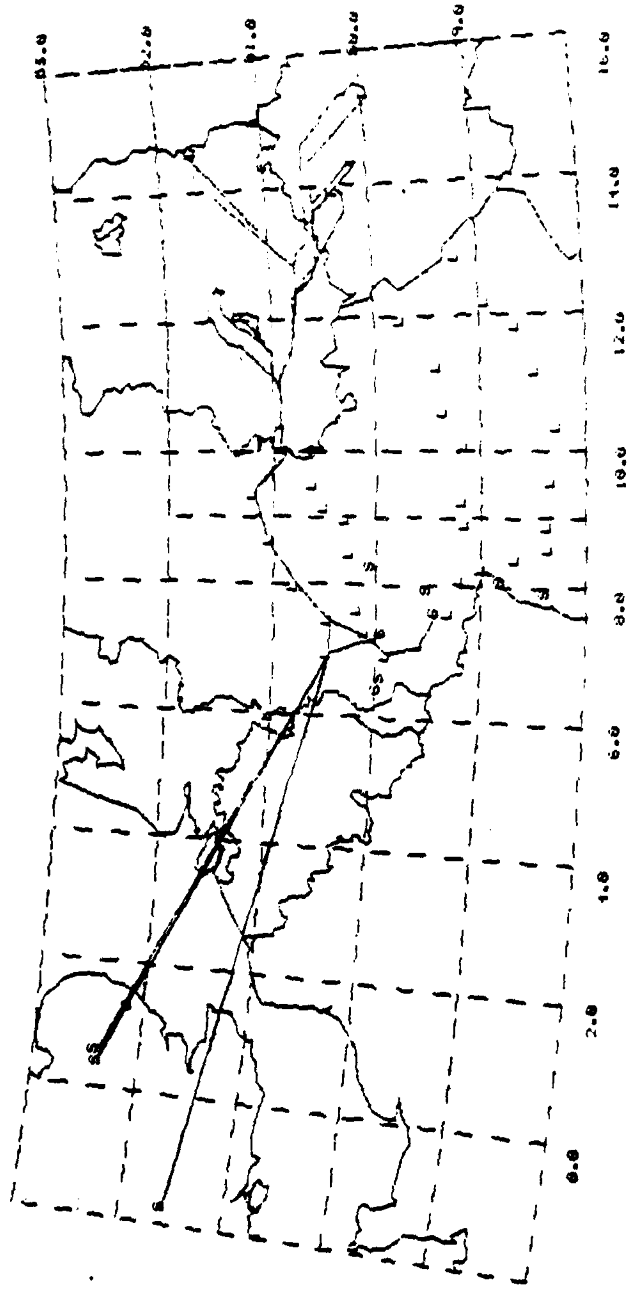


Figure V-10

(At this point the threat suppression features will be exercised. The first example will show how to analyze a route for threat exposure.)

: < AN FAIRZOLL01 >

```
ANALIZ-- NUMBER OF CRITICAL POINTS:     39
         NUMBER OF THREATS        :     67
         ALTITUDE OF ROUTE        :    60.10
         TOTAL PROB OF SURVIVAL   :  0.061770
         TOTAL DISTANCE OF ROUTE  : 1123.5223
```

INDEX	TIME (MIN)	LATITUDE (DMS)	LONGITUDE (DMS)	HEADING (DEG)	ALT (FT)	LEG PS	NODE NAME
1	0.0	51 34 60	-1 45 00	101.59	197	1.000	FAIRFORD
2	41.9	50 26 54	6 56 16	89.73	197	0.987	N001
3	44.4	50 26 59	7 26 33	46.31	197	0.999	N002
4	48.0	50 46 50	7 59 24	56.62	197	0.999	N003
5	51.4	51 01 47	8 35 29	72.33	197	0.999	N004
6	55.3	51 11 12	9 22 43	133.05	197	0.999	N005
7	58.7	50 52 30	9 54 27	62.99	197	0.891	WAYPOINT
8	59.4	50 54 60	10 02 14	90.00	197	0.896	WAYPOINT
9	63.4	50 54 60	10 52 47	71.21	197	0.447	WAYPOINT
10	64.4	50 57 30	11 04 27	44.39	197	0.954	WAYPOINT
11	64.8	51 00 00	11 08 21	90.00	197	0.993	WAYPOINT
12	66.3	51 00 00	11 27 48	44.34	197	0.991	WAYPOINT
13	67.2	51 04 60	11 35 34	90.00	197	1.000	WAYPOINT
14	67.5	51 04 60	11 39 28	44.31	197	1.000	WAYPOINT
15	68.0	51 07 30	11 43 21	90.00	197	0.999	WAYPOINT
16	69.5	51 07 30	12 02 48	0.00	197	0.986	WAYPOINT
17	69.8	51 09 60	12 02 48	44.26	197	0.939	WAYPOINT
18	70.2	51 12 30	12 06 41	0.00	197	0.778	WAYPOINT
19	70.6	51 15 00	12 06 41	11.13	197	0.831	WAYPOINT
20	70.7	51 16 00	12 07 00	299.67	197	0.981	ZOLLSCHN
21	71.1	51 17 30	12 02 48	224.29	197	0.995	WAYPOINT
22	72.4	51 09 60	11 51 08	270.00	197	0.987	WAYPOINT
23	72.7	51 09 60	11 47 14	224.34	197	0.998	WAYPOINT
24	73.6	51 04 60	11 39 28	270.00	197	0.996	WAYPOINT
25	73.9	51 04 60	11 35 34	224.39	197	1.000	WAYPOINT
26	74.7	51 00 00	11 27 48	270.00	197	1.000	WAYPOINT
27	76.3	51 00 00	11 08 21	224.42	197	0.991	WAYPOINT
28	76.7	50 57 30	11 04 27	251.23	197	0.993	WAYPOINT
29	77.7	50 54 60	10 52 47	270.00	197	0.954	WAYPOINT
30	79.8	50 54 60	10 25 34	315.61	197	0.740	WAYPOINT
31	80.7	51 00 00	10 17 47	270.00	197	0.814	WAYPOINT
32	83.2	51 00 00	9 46 40	304.30	197	0.604	WAYPOINT
33	84.3	51 04 60	9 35 00	308.86	197	0.977	WAYPOINT
34	85.5	51 11 12	9 22 43	252.39	197	1.000	N005
35	89.4	51 01 47	8 35 29	236.77	197	0.999	N004
36	92.8	50 46 50	7 59 24	226.51	197	0.999	N003
37	96.4	50 26 59	7 26 33	269.73	197	0.999	N002

38	98.8	50 26 54	6 56 16	281.37	197	0.999	N001
39	140.8	51 34 60	-1 45 00	281.37	197	0.987	FAIRFORD

ANALIZ -- THREAT EXPOSURE ANALYSIS FOR BOMBER ROUTE: FAIRZOLL01 (3)
TIME ON TARGET: 70.7 MINUTES

ANALIZ -- T H R E A T: S613 (SA-6 / 18.50 NM RADIUS)

	ENTER COVERAGE	BECOME UNMASKED	BECOME MASKED	LEAVE COVERAGE	EXPOSURE TIME	PK
INGRESS	57.70	58.94	61.36	61.64	2.43	0.020
EGRESS	79.42	81.56	82.99	82.99	1.43	0.000
TOTAL					3.86	0.021

ANALIZ -- T H R E A T: S614 (SA-6 / 18.50 NM RADIUS)

	ENTER COVERAGE	BECOME UNMASKED	BECOME MASKED	LEAVE COVERAGE	EXPOSURE TIME	PK
INGRESS	58.57	---- NO EXPOSURE ----		61.33	0.00	0.000
EGRESS	79.74	---- NO EXPOSURE ----		79.98	0.00	0.000
TOTAL					0.00	0.000

ANALIZ -- T H R E A T: S615 (SA-6 / 18.50 NM RADIUS)

	ENTER COVERAGE	BECOME UNMASKED	BECOME MASKED	LEAVE COVERAGE	EXPOSURE TIME	PK
INGRESS	57.64	58.94	61.27	62.08	2.34	0.019
EGRESS	78.99	81.80	83.17	83.17	1.37	0.000
TOTAL					3.71	0.019

ANALIZ -- T H R E A T: S616 (SA-6 / 18.50 NM RADIUS)

	ENTER COVERAGE	BECOME UNMASKED	BECOME MASKED	LEAVE COVERAGE	EXPOSURE TIME	PK
INGRESS	57.41	58.94	61.28	62.36	2.34	0.161
EGRESS	78.71	81.25	83.43	83.46	2.18	0.035
TOTAL					4.53	0.191

ANALIZ -- T H R E A T: S618 (SA-6 / 18.50 NM RADIUS)

	ENTER COVERAGE	BECOME UNMASKED	BECOME MASKED	LEAVE COVERAGE	EXPOSURE TIME	PK
INGRESS	58.42	---- NO EXPOSURE ----		62.16	0.00	0.000
EGRESS	78.91	---- NO EXPOSURE ----		81.78	0.00	0.000
TOTAL					0.00	0.000

ANALIZ -- T H R E A T: S619 (SA-6 / 18.50 NM RADIUS)

	ENTER COVERAGE	BECOME UNMASKED	BECOME MASKED	LEAVE COVERAGE	EXPOSURE TIME	PK
INGRESS	60.39	---- NO EXPOSURE ----		65.13	0.00	0.000
EGRESS	75.94	---- NO EXPOSURE ----		81.03	0.00	0.000
TOTAL					0.00	0.000

ANALIZ -- T H R E A T: A009 (ZSU-23-4/ 3.00 NM RADIUS)

	ENTER COVERAGE	BECOME UNMASKED	BECOME MASKED	LEAVE COVERAGE	EXPOSURE TIME	PK
INGRESS		-- THREAT NOT ENCOUNTERED --				
EGRESS	81.47	81.83	82.18	82.18	0.35	0.035
TOTAL					0.35	0.035

ANALIZ -- T H R E A T: SE02 (SQUATEYE/ 51.23 NM RADIUS)

	ENTER COVERAGE	BECOME UNMASKED	BECOME MASKED	LEAVE COVERAGE	EXPOSURE TIME	PK
INGRESS	64.40	67.74	70.68	70.68	2.94	0.032
EGRESS	70.68	70.68	76.67	76.67	5.99	0.026
TOTAL					8.93	0.057

ANALIZ -- T H R E A T: SE03 (SQUATEYE/ 51.23 NM RADIUS)

	ENTER COVERAGE	BECOME UNMASKED	BECOME MASKED	LEAVE COVERAGE	EXPOSURE TIME	PK
INGRESS	68.92	---- NO EXPOSURE ----		70.68	0.00	0.000
EGRESS		-- THREAT NOT ENCOUNTERED --				
TOTAL					0.00	0.000

ANALIZ -- T H R E A T: SE09 (FARMGATE/ 42.81 NM RADIUS)

	ENTER COVERAGE	BECOME UNMASKED	BECOME MASKED	LEAVE COVERAGE	EXPOSURE TIME	PK
INGRESS	68.84	---- NO EXPOSURE ----		70.68	0.00	0.000
EGRESS	70.68	---- NO EXPOSURE ----		72.82	0.00	0.000
TOTAL					0.00	0.000

ANALIZ -- T H R E A T: SE12 (SQUATEYE/ 51.23 NM RADIUS)

	ENTER COVERAGE	BECOME UNMASKED	BECOME MASKED	LEAVE COVERAGE	EXPOSURE TIME	PK
INGRESS	53.10	63.63	67.28	67.28	3.65	0.011
EGRESS	73.78	75.50	87.71	87.71	12.21	0.011

TOTAL 15.35 0.022

ANALIZ -- T H R E A T: SE13 (TALLKING/ 47.62 NM RADIUS)

	ENTER COVERAGE	BECOME UNMASKED	BECOME MASKED	LEAVE COVERAGE	EXPOSURE TIME	PK
INGRESS	54.11	---- NO EXPOSURE ----		65.74	0.00	0.000
EGRESS	75.31	82.07	86.71	86.71	4.64	0.002
TOTAL					4.64	0.002

ANALIZ -- T H R E A T: SE14 (BARLOCK / 44.40 NM RADIUS)

	ENTER COVERAGE	BECOME UNMASKED	BECOME MASKED	LEAVE COVERAGE	EXPOSURE TIME	PK
INGRESS	59.92	---- NO EXPOSURE ----		69.28	0.00	0.000
EGRESS	72.17	---- NO EXPOSURE ----		81.03	0.00	0.000
TOTAL					0.00	0.000

ANALIZ -- T H R E A T: S804 (SA-8 / 9.00 NM RADIUS)

	ENTER COVERAGE	BECOME UNMASKED	BECOME MASKED	LEAVE COVERAGE	EXPOSURE TIME	PK
INGRESS		-- THREAT NOT ENCOUNTERED --				
EGRESS	80.57	---- NO EXPOSURE ----		81.88	0.00	0.000
TOTAL					0.00	0.000

ANALIZ -- T H R E A T: S815 (SA-8 / 9.00 NM RADIUS)

	ENTER COVERAGE	BECOME UNMASKED	BECOME MASKED	LEAVE COVERAGE	EXPOSURE TIME	PK
INGRESS	69.38	69.64	70.68	70.68	1.04	0.538
EGRESS	70.68	70.68	72.00	72.00	1.32	0.000
TOTAL					2.36	0.538

CPUTIM,WALLTIM,PAGEFLTS= 4.650 19.430 0.000

(This is the route analysis feature. First, the leg-by-leg probability of survival is computed and printed out along with the route waypoints. Next, a threat exposure report is given. A list is generated for each threat through which the user selected route flies. The time at which the route enters the threat coverage (time-in) and the time the route leaves threat coverage (time-out) for both ingress and egress is given. In addition, the times at which the route is masked and unmasked are also given, along with the Pk contribution of that threat to the total route Pk. NOTE: At this time, the route analysis feature is still under development. The Pk contributions for the individual threats is not always consistent with the total route Pk. A major reason for this is that stochastic threats are not yet considered by the analysis feature.

Therefore, the user is advised to use the Pk numbers with care. At present, they indicate which fixed threats are the most dangerous and therefore, which threats should be suppressed.)

(Now the user will input the locations of the threat suppression assets he wishes to use in this scenario. First, there are three records in the SUPM table which are of interest to the user. These are the three suppressor models.)

```
 : < SHOW SUPM 2 4 >

CRSHOW -- RECORD      2     IDWORD=EF-111
         ID  =    EF-111
         RAD = 3.5000E+01
         ICAP=        12
         TYPE=    SA-2B        SA-2F        SA-3
                  SA-4         BARLOCK      BIGBAR
                  NYSAC        SPONREST     FLATFACE
                  SQUATEYE     FARMGATE     TALLKING
                  BACKNET      BACKTRAP



         DEGR= 9.0000E-01 9.0000E-01 9.0000E-01 9.0000E-01
               9.0000E-01 9.0000E-01 9.0000E-01 9.0000E-01
               9.0000E-01 9.0000E-01 9.0000E-01 9.0000E-01
               9.0000E-01 9.0000E-01 0.0000E+00 0.0000E+00
               0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
               0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
               0.0000E+00
         IDC =    85/11/22 16:43
         IDM =    85/11/22 16:43

CRSHOW -- RECORD      3     IDWORD=COMPCALL
         ID  =    COMPCALL
         RAD = 4.0000E+01
         ICAP=        20
         TYPE=    SA-2B        SA-2F        SA-3
                  SA-4         SA-11        ZSU-23-4
                  BARLOCK      BIGBAR       NYSAC
                  SPONREST     FLATFACE     SQUATEYE
                  FARMGATE     TALLKING     BACKNET



         DEGR= 8.0000E-01 8.0000E-01 8.0000E-01 8.0000E-01
               8.0000E-01 8.0000E-01 8.0000E-01 8.0000E-01
               8.0000E-01 8.0000E-01 8.0000E-01 8.0000E-01
               8.0000E-01 8.0000E-01 8.0000E-01 8.0000E-01
               8.0000E-01 8.0000E-01 0.0000E+00 0.0000E+00
```

```
              0.0000E+00 0.0000E+00 0.0000E-00 0.0000E-00
              0.0000E-00
        IDC =     85/11/22 16:43
        IDM =     85/11/22 16:43

CRSHOW -- RECORD      4    IDWORD=WILDWEAS
        ID  =     WILDWEAS
        RAD = 1.5000E-01
        ICAP=           6
        TYPE=     SA-6CC      SA-8CC




        DEGR= 8.0000E-01 8.0000E-01 0.0000E+00 0.0000E+00
              0.0000E+00 0.0000E+00 0.0000E+00 0.000CE+00
              0.0000E+00 0.0000E+00 0.0000E+00 0.000CE+00
              0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
              0.0000E+00 0.0000E+00 0.0000E+00 0.0000E-00
              0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
              0.0000E+00
        IDC =     85/11/22 16:43
        IDM =     85/11/22 16:43

        CPUTIM,WALLTIM,PAGEFLTS=     0.240     3.457     6.000
```

(Suppressors are positioned with the LOCATE command. The user must first scale the display and choose the display options he wants.)

```
: < DI SC 8 16 48.75 51.75 >                    (Rescale the display)

        CPUTIM,WALLTIM,PAGEFLTS=     0.030     0.121     0.000

: < DI M D RO / >


 PROMPL-RCID:


  ENTER ID OR RECORD NUMBER FOR A SINGLE RECORD IN SPED
   OR ENTER STARTING AND ENDING RECORD NUMBERS SEP-
   ARATED BY SPACE OR COMMA FOR A RANGE OF RECORDS
 REC1 "to" REC2 or IDWORD:

   < FAIRZOLL01 >


 PROMPL-FILE:
```

```
 ENTER ALTG TO PLOT OPTIMAL ALTITUDES ABOVE GROUND
       ALTS         OPTIMAL ALTITUDES (MSL)
       CL3D         DANGER FROM CLOBBER
       STAT         TOTAL DANGER AT OPTIMAL ALT
       TH2D         THREAT DANGER AT OPTIMAL ALT
       TH3D         THREAT DANGER AT ANY ALTITUDE

FILE--ALTG,ALTS,CL3D,STAT,TH2D,TH3D:

  < STAT >


PROMPL-LEVE:


 ENTER VALUE OF FIRST CONTOUR LEVEL
   OR ENTER "D" TO USE DEFAULT LEVELS:
     0.3000     0.2000     0.1000     0.0500     0.0100
NEXT CONTOUR LEVEL, DEFAULT(D), or /:

  < D >


PROMPL-DIRE:


 ENTER 0 FOR DANGER AVERAGED OVER ALL 8 DIRECTIONS
       1 FOR DANGER HEADING NORTHWEST
       2                    WEST
       3                    SOUTHWEST
       4                    SOUTH
       5                    NORTH
       6                    NORTHEAST
       7                    EAST
       8                    SOUTHEAST
DIRECTION (0=ave or 1-8):

  <  7 >

CNTDGR--NH,NV,LVSEG,NVSEG,NAVE,LREAD=   73  109   19    6    8  584
         CPUTIM,WALLTIM,PAGEFLTS=     8.720    49.598     6.000
```

(The results of this plot are shown in Figure V-11. These are the unsuppressed danger contours, together with the route "FAIRZOLL01". Note that FLAPS provided helpful prompts when the type ahead feature was not used.)

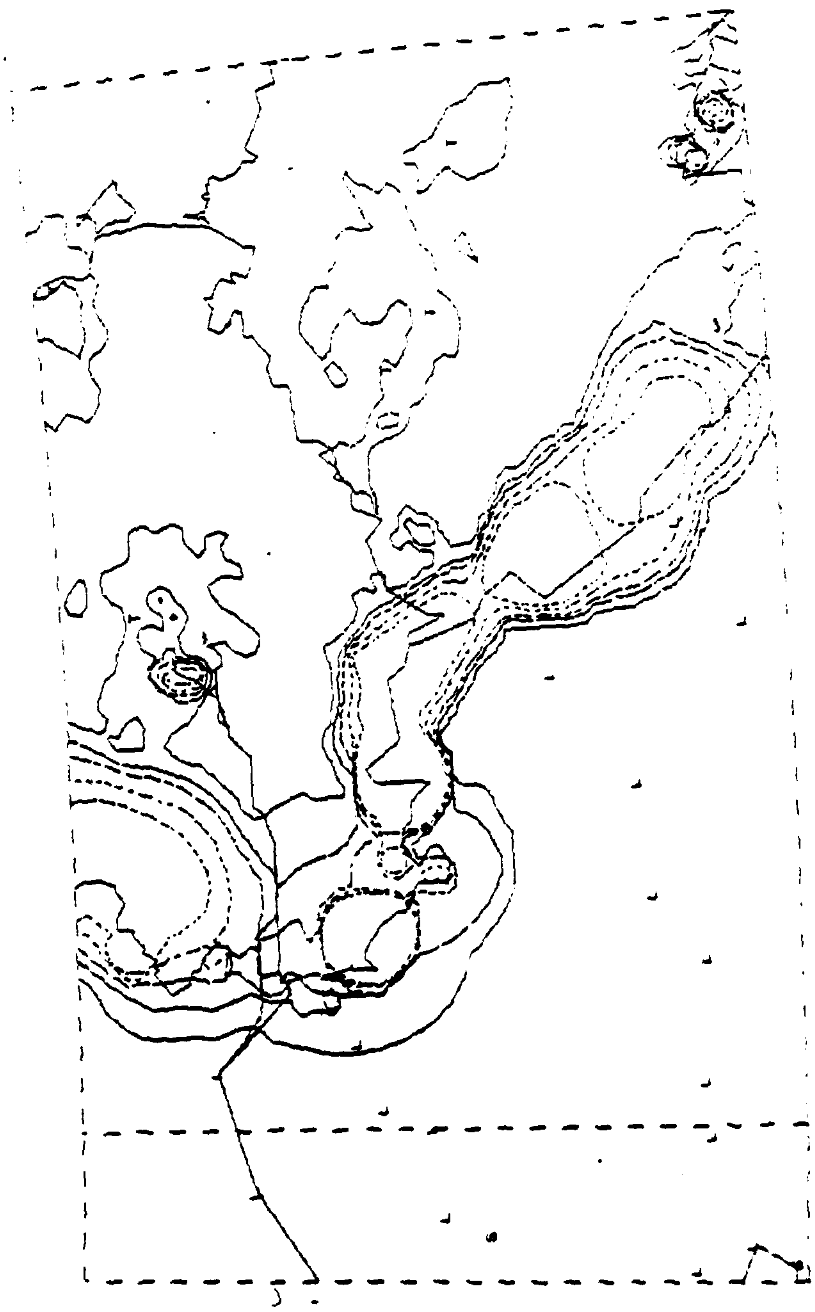


Figure V-11

(The user will now position two suppressors of each type using the LOCATE command. One suppressor of each type will be placed in the north, and the other in the south.)

```
: < LOCATE >

        MOVE CURSOR TO SUPPRESSION POSITION
```

(Here the user moves the cursor to the position he wants to put the suppressor.)

```
 CHOOSE SUPPRESSION MODEL (ID) or "AB" TO ABORT:
 < EF-111 >
 ENTER  8 CHAR SUPP ID, "/" FOR PROGRAM SELECTION or "AB"ort:
 < / >

 LOCATE -- NEW SUPP ID  EF-111.1 WRITTEN TO RECORD       2

          CPUTIM,WALLTIM,PAGEFLTS=      0.130     9.336     1.000

: < LOCATE >

        MOVE CURSOR TO SUPPRESSION POSITION

 CHOOSE SUPPRESSION MODEL (ID) or "AB" TO ABORT:
 < EF-111 >
 ENTER  8 CHAR SUPP ID, "/" FOR PROGRAM SELECTION or "AB"ort:
 < / >

 LOCATE -- NEW SUPP ID  EF-111.2 WRITTEN TO RECORD       3

          CPUTIM,WALLTIM,PAGEFLTS=      0.130     9.336     1.000
: < LOCATE >

        MOVE CURSOR TO SUPPRESSION POSITION

 CHOOSE SUPPRESSION MODEL (ID) or "AB" TO ABORT:
 < COMPCALL >
 ENTER  8 CHAR SUPP ID, "/" FOR PROGRAM SELECTION or "AB"ort:
 < / >

 LOCATE -- NEW SUPP ID  COMPCA.1 WRITTEN TO RECORD       4

          CPUTIM,WALLTIM,PAGEFLTS=      0.130     9.336     1.000
: < LOCATE >

        MOVE CURSOR TO SUPPRESSION POSITION

 CHOOSE SUPPRESSION MODEL (ID) or "AB" TO ABORT:
 < COMPCALL >
 ENTER  8 CHAR SUPP ID, "/" FOR PROGRAM SELECTION or "AB"ort:
 < / >
```

```
LOCATE -- NEW SUPP ID  COMPCA.2 WRITTEN TO RECORD        5

          CPUTIM,WALLTIM,PAGEFLTS=     0.130     9.336     1.000
: < LOCATE >

        MOVE CURSOR TO SUPPRESSION POSITION

 CHOOSE SUPPRESSION MODEL (ID) or "AB" TO ABORT:
 < WILDWEAS >
 ENTER  8 CHAR SUPP ID, "/" FOR PROGRAM SELECTION or "AB"ort:
 < / >

 LOCATE -- NEW SUPP ID  WILDWE.1 WRITTEN TO RECORD       6

          CPUTIM,WALLTIM,PAGEFLTS=     0.130     9.336     1.000
: < LOCATE >

        MOVE CURSOR TO SUPPRESSION POSITION

 CHOOSE SUPPRESSION MODEL (ID) or "AB" TO ABORT:
 < WILDWEAS >
 ENTER  8 CHAR SUPP ID, "/" FOR PROGRAM SELECTION or "AB"ort:
 < / >

 LOCATE -- NEW SUPP ID  WILDWE.2 WRITTEN TO RECORD       7

          CPUTIM,WALLTIM,PAGEFLTS=     0.130     9.336     1.000
```

(The user can check these positions as follows.)

```
:  < DI SU / >


 THTYPE-SMDL:

  ENTER ALL TO SELECT ALL MODELS
    OR  /   TO USE CURRENT SELECTION
    OR ENTER A NAME OF A MODEL TO BE ADDED TO LIST
   NAME-STATUS   NAME-STATUS   NAME-STATUS   NAME-STATUS   NAME-STATUS

   EF-111  -     COMPCALL-     WILDWEAS-
 CHOOSE SUPPRESSOR MODEL (ID),ALL OR /:

   < ALL >

 CNTDGR--NH,NV,LVSEG,NVSEG,NAVE,LREAD=   73  109   19    6    8  584
          CPUTIM,WALLTIM,PAGEFLTS=     9.040    14.371     8.000
```

(The results of this display can be seen in Figure V-12. The suppressors all seem to be in the right place. This deployment should open two corridors through the FEBA. Now FLAPS will calculate the suppressor effectiveness using the SUPRES command.)

```
:· < SUPRES >

SUPRES - SUPPRESSOR EF-1111 (EF-111  ) IN RANGE OF     4.0 FIXED THREATS
         AND      0.0 STOCHASTIC THREATS.  CAPACITY IS    12 TOTAL THREATS.
  RMAX,IDSC,ILXT,IUXT,JLXT,JUXT=    9.00    M804    51    67    36    51

 NXSC,NYSC,DXSC,DYSC,XMINSC,YMINSC=  8   7    0.0648    0.0417   12.5231
                                    49.6325

PRESTC--NTOT,NSUP,FSUP=   34   11  0.3235
  RMAX,IDSC,ILXT,IUXT,JLXT,JUXT=    9.00    M806    35    59    45    65

 NXSC,NYSC,DXSC,DYSC,XMINSC,YMINSC=  17  13    0.0648    0.0417   11.4564
                                    50.0000

PRESTC--NTOT,NSUP,FSUP=   64   13  0.2031

SUPRES - SUPPRESSOR WILDWE1 (WILDWEAS) IN RANGE OF     0.0 FIXED THREATS
         AND      2.1 STOCHASTIC THREATS.  CAPACITY IS     6 TOTAL THREATS.

SUPRES - SUPPRESSOR COMPCA1 (COMPCALL) IN RANGE OF     3.0 FIXED THREATS
         AND      0.0 STOCHASTIC THREATS.  CAPACITY IS    20 TOTAL THREATS.

SUPRES - SUPPRESSOR EF-1112 (EF-111  ) IN RANGE OF    10.0 FIXED THREATS
         AND      0.0 STOCHASTIC THREATS.  CAPACITY IS    12 TOTAL THREATS.
  RMAX,IDSC,ILXT,IUXT,JLXT,JUXT=   18.50    M603     6    37    50    80

 NXSC,NYSC,DXSC,DYSC,XMINSC,YMINSC=  15  15    0.0648    0.0417    9.8792
                                    50.3753

PRESTC--NTOT,NSUP,FSUP=  181   56  0.3094
  RMAX,IDSC,ILXT,IUXT,JLXT,JUXT=    9.00    M801    16    40    73    97

 NXSC,NYSC,DXSC,DYSC,XMINSC,YMINSC=  17  16    0.0648    0.0417   10.2314
                                    51.1875

PRESTC--NTOT,NSUP,FSUP=  220    0  0.0000

SUPRES - SUPPRESSOR WILDWE2 (WILDWEAS) IN RANGE OF     0.0 FIXED THREATS
         AND      0.6 STOCHASTIC THREATS.  CAPACITY IS     6 TOTAL THREATS.

SUPRES - SUPPRESSOR COMPCA2 (COMPCALL) IN RANGE OF    13.0 FIXED THREATS
         AND      0.0 STOCHASTIC THREATS.  CAPACITY IS    20 TOTAL THREATS.

SUPRES-CONT:

 SUPPRESSION IS FAIRLY TIME CONSUMING  -- REVIEW
 PREVIOUS LIST OF THREATS AFFECTED BY SUPPRESSORS
 AND DECIDE WHETHER TO APPLY SUPPRESSION
```

```
DO YOU WISH TO CONTINUE (YES OR NO) ?:

< YES >          (No capacities have been exceeded, so continue)

*********************************************
            STATES  "RS"  EXECUTING

  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=   20.00    S203     7    25    73    90
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=   20.00    S204    11    28    69    86
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=   20.00    S205     8    26    64    81
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=   20.00    S206     9    26    69    86
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=   20.00    S207     8    25    60    77
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=   20.00    S209    47    64    40    57
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=   31.00    S211     4    30    60    85
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=   31.00    S212     4    30    58    84
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=   31.00    S213    37    62    44    70
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=   31.00    S216    27    53    46    72
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=    3.00    A008    16    20    62    66
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=    3.00    A009    16    19    72    75
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=    3.00    A010    16    20    62    66
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=   43.00    S401     1    36    47    82
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=   51.23    SE01    38    80    29    71
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=   51.23    SE12     1    42    58    97
  RMAX,IDTH,ILXT,IUXT,JLXT,JUXT=   47.62    SE13     1    39    46    85
  RMAX,IDSC,ILXT,IUXT,JLXT,JUXT=   18.50    M603     6    37    50    80

 NXSC,NYSC,DXSC,DYSC,XMINSC,YMINSC=  15  15    0.0648    0.0417     9.8792
                                     50.3753

PRESTC--NTOT,NSUP,FSUP=  181    56  0.3094
  RMAX,IDSC,ILXT,IUXT,JLXT,JUXT=    9.00    M804    51    67    36    51

 NXSC,NYSC,DXSC,DYSC,XMINSC,YMINSC=   8   7    0.0648    0.0417    12.5231
                                     49.6325

PRESTC--NTOT,NSUP,FSUP=   34    11  0.3235
  RMAX,IDSC,ILXT,IUXT,JLXT,JUXT=    9.00    M806    35    59    45    65

 NXSC,NYSC,DXSC,DYSC,XMINSC,YMINSC=  17  13    0.0648    0.0417    11.4564
                                     50.0000

PRESTC--NTOT,NSUP,FSUP=   64    13  0.2031
         CPUTIM,WALLTIM,PAGEFLTS=     47.770    134.629  2161.000
```

(This is the output produced by the statespace suppression routine. These threats have been suppressed by the appropriate amount. The rest of the threats are unaffected by the current set of suppression aircraft.)

```
: < DI P / >

         CPUTIM,WALLTIM,PAGEFLTS=      0.030      0.121      0.000
```

```
: < DI M SU D / >

THTYPE-SMDL:

 ENTER ALL TO SELECT ALL MODELS
   OR  /   TO USE CURRENT SELECTION
   OR ENTER A NAME OF A MODEL TO BE ADDED TO LIST
  NAME-STATUS   NAME-STATUS   NAME-STATUS   NAME-STATUS   NAME-STATUS

  EF-111   -    COMPCALL-     WILDWEAS-
CHOOSE SUPPRESSOR MODEL (ID),ALL OR /:

  < ALL>

PROMPL-FILE:

 ENTER ALTG TO PLOT OPTIMAL ALTITUDES ABOVE GROUND
       ALTS         OPTIMAL ALTITUDES (MSL)
       CL3D         DANGER FROM CLOBBER
       STAT         TOTAL DANGER AT OPTIMAL ALT
       TH2D         THREAT DANGER AT OPTIMAL ALT
       TH3D         THREAT DANGER AT ANY ALTITUDE

FILE--ALTG,ALTS,CL3D,STAT,TH2D,TH3D:

  < STAT >

PROMPL-LEVE:

 ENTER VALUE OF FIRST CONTOUR LEVEL
   OR ENTER "D" TO USE DEFAULT LEVELS:
     0.3000    0.2000    0.1000    0.0500    0.0100
NEXT CONTOUR LEVEL, DEFAULT(D), or /:

  < D 7 >

CNTDGR--NH,NV,LVSEG,NVSEG,NAVE,LREAD=   73  109   19    6    8  584
         CPUTIM,WALLTIM,PAGEFLTS=      9.500     34.480    289.000
```

(This display shows the effect of the suppression on the statespace. The result of this command is shown in Figure V-13. Compare this Figure to Figure V-12. Note that two high probability of survival corridors have been opened by the suppressors. Also note that there is still some threat danger in the two corridors. This is because the threat suppression models are not produce 100 percent degrades. Now the user will recompute the routes and weapons

allocation using the REROUTE command.)

```
: < RR >

**************************************************
            ARCSS EXECUTING


GETARC -- RETRIEVE TRAJECTORIES FROM EXIT TO TGT  TARGET: PANENSKY ( 121)
   GETARC -- TO EXIT  N005     (  48) DIST,PS =   247.1  0.67258
   GETARC -- TO EXIT  N028     (  49) DIST,PS =   212.4  0.66051
   GETARC -- TO EXIT  S092     (  50) DIST,PS =    93.8  0.68223
   GETARC -- TO EXIT  S133     (  51) DIST,PS =   154.3  0.47759

GETARC -- RETRIEVE TRAJECTORIES FROM TGT  TO EXIT TARGET: PANENSKY ( 121)
   GETARC -- TO EXIT  N005     (  48) DIST,PS =   255.5  0.60524
   GETARC -- TO EXIT  N028     (  49) DIST,PS =   220.8  0.59437
   GETARC -- TO EXIT  S092     (  50) DIST,PS =   104.1  0.61299
   GETARC -- TO EXIT  S133     (  51) DIST,PS =   164.6  0.43072

                          .
                          .
                          .

GETARC -- RETRIEVE TRAJECTORIES FROM EXIT TO TGT  TARGET: PRAGUE   ( 126)
   GETARC -- TO EXIT  N005     (  48) DIST,PS =   258.8  0.65622
   GETARC -- TO EXIT  N028     (  49) DIST,PS =   224.2  0.64443
   GETARC -- TO EXIT  S092     (  50) DIST,PS =   105.6  0.66563
   GETARC -- TO EXIT  S133     (  51) DIST,PS =   166.0  0.46597

GETARC -- RETRIEVE TRAJECTORIES FROM TGT  TO EXIT TARGET: PRAGUE   ( 126)
   GETARC -- TO EXIT  N005     (  48) DIST,PS =   265.4  0.58081
   GETARC -- TO EXIT  N028     (  49) DIST,PS =   230.7  0.57038
   GETARC -- TO EXIT  S092     (  50) DIST,PS =   114.0  0.58825
   GETARC -- TO EXIT  S133     (  51) DIST,PS =   174.5  0.41333

*******************************************
                 ROUTES EXECUTING

        6 ROUTES CREATED TO TARGET PANENSKY
        6 ROUTES CREATED TO TARGET ZOLLSCHN
        6 ROUTES CREATED TO TARGET PRESCHEN
        6 ROUTES CREATED TO TARGET CASLAV
        7 ROUTES CREATED TO TARGET LEIPZIG
        7 ROUTES CREATED TO TARGET PRAGUE

    ROUTINE ROUTES FINISHED.
    A TOTAL OF     38 ROUTES ASSEMBLED TO
    A TOTAL OF      6 TARGETS. RESULTS
    APPEAR IN ARRAY ROUT

********************************************
```

```
          ALLOC EXECUTING

 ALLOCATION COMPLETED FOR     6 TARGETS.
 RESULTS APPEAR IN TARGET STATUS ARRAY : TGUS

         CPUTIM,WALLTIM,PAGEFLTS=    39.570    55.063   828.000

: < SELECT ALL >

SPWRIT -- SELECTED ROUTE WRITTEN TO SPED: ID HAHNPRAG01  RECORD      2
SPWRIT -- SELECTED ROUTE WRITTEN TO SPED: ID RAMSLEIP01  RECORD      3
SPWRIT -- SELECTED ROUTE WRITTEN TO SPED: ID MILDCASL01  RECORD      4
SPWRIT -- SELECTED ROUTE WRITTEN TO SPED: ID RAMSPRES01  RECORD      5
SPWRIT -- SELECTED ROUTE WRITTEN TO SPED: ID FAIRZOLL01  RECORD      6
SPWRIT -- SELECTED ROUTE WRITTEN TO SPED: ID LAKEPANE01  RECORD      7

         CPUTIM,WALLTIM,PAGEFLTS=     0.880     2.461    57.000

: < SHOW TGUS >
```

TARGET	STAGING BASE	AIRCRAFT ALLOCATED	WEAPON TYPE	PD ACHIEVED	ROUTE PS	ROUTE DIST (NM)
PANENSKY	LAKENHTH	2 F111	CBU-38	0.878	0.40	1208.8
ZOLLSCHN	FAIRFORD	4 F111	MARK-84	0.990	0.22	1398.8
PRESCHEN	RAMSTEIN	2 F-16	MARK-20	0.900	0.33	709.8
CASLAV	MILDENHA	2 F111	MARK-20	0.961	0.37	1326.2
LEIPZIG	RAMSTEIN	4 F-16	AGM-65	0.999	0.37	695.7
PRAGUE	HAHN	4 F-16	AGM-65	0.999	0.39	661.3

```
         CPUTIM,WALLTIM,PAGEFLTS=     0.090     0.949    22.000
```

(Compare the survivability of these routes with those created without suppression.)

```
: < DI RO / 2 7 >

         CPUTIM,WALLTIM,PAGEFLTS=    14.790    31.898    55.000
```

(The results of this display can be seen in Figure V-14. Note that, even though the routes used the northern corridor before suppression, all of the routes now take advantage of the new southern corridor.)

```
: < DI RO / FAIRZOLL01 >

         CPUTIM,WALLTIM,PAGEFLTS=    11.710    38.500     2.000
```

(The results of this display can be seen in Figure V-15. The route has changed to take advantage of the threat suppression corridor and the probability of survival has improved significantly.)

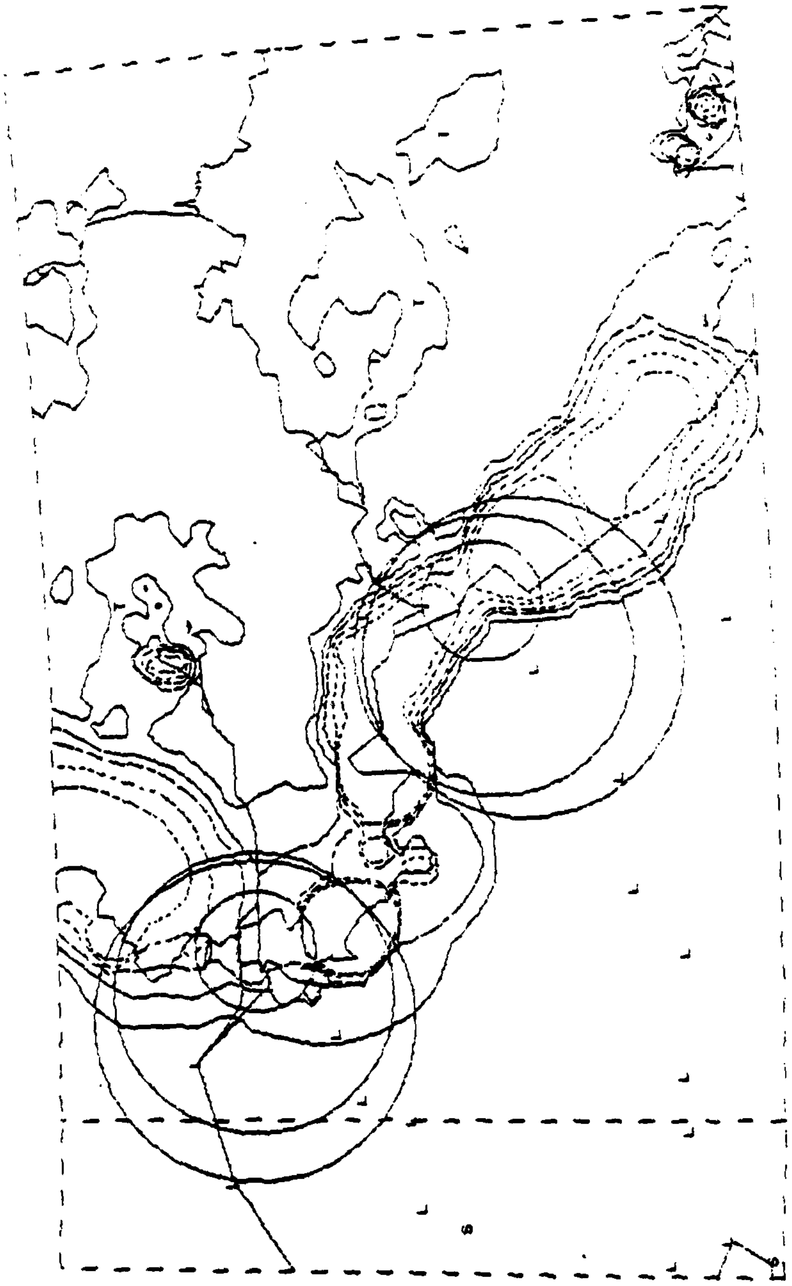


Figure V-12

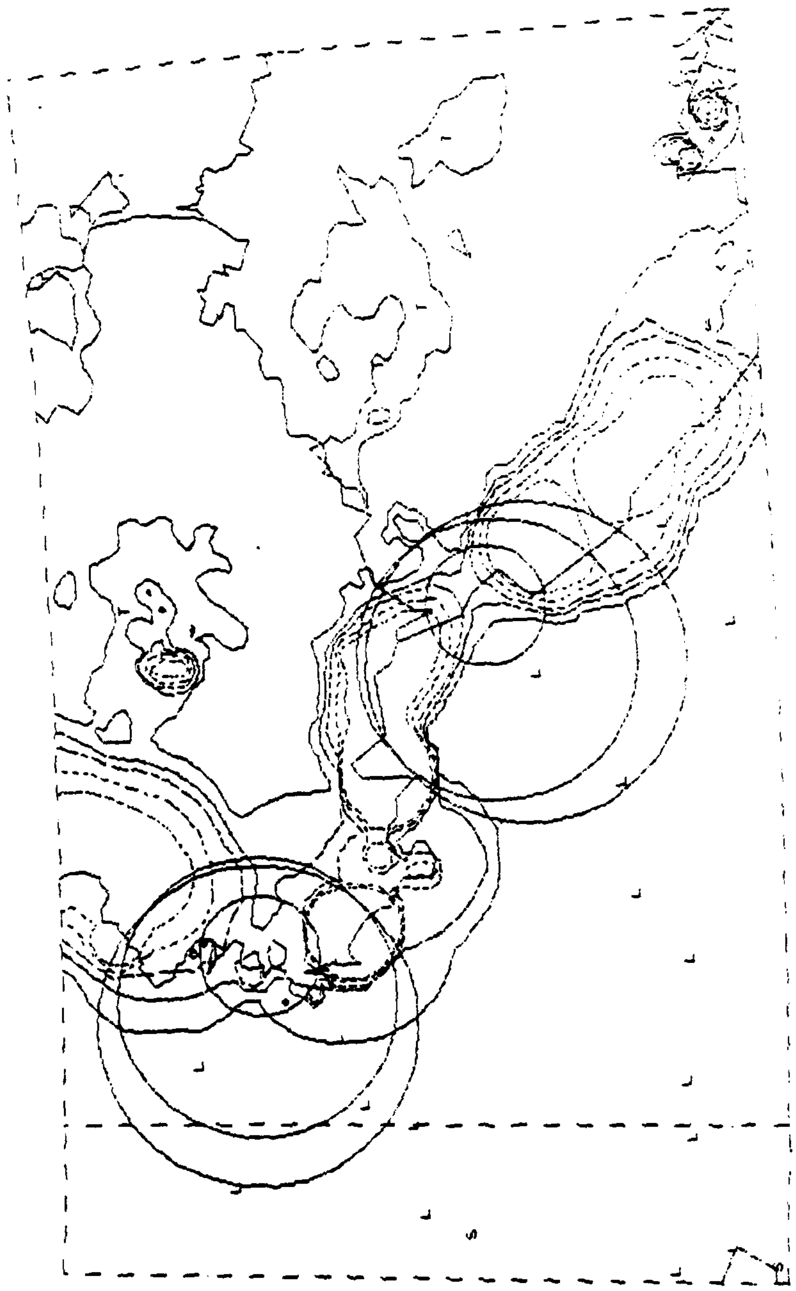


Figure V-13

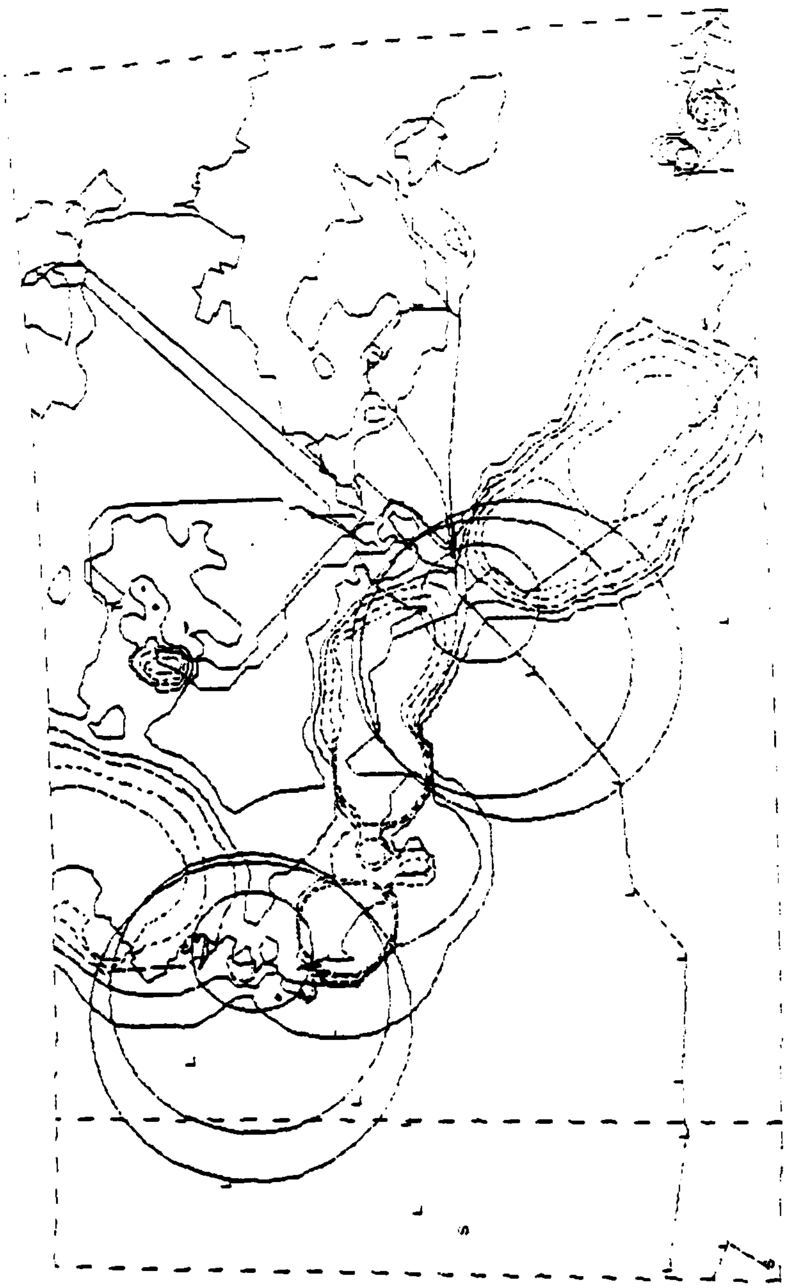


Figure V-14

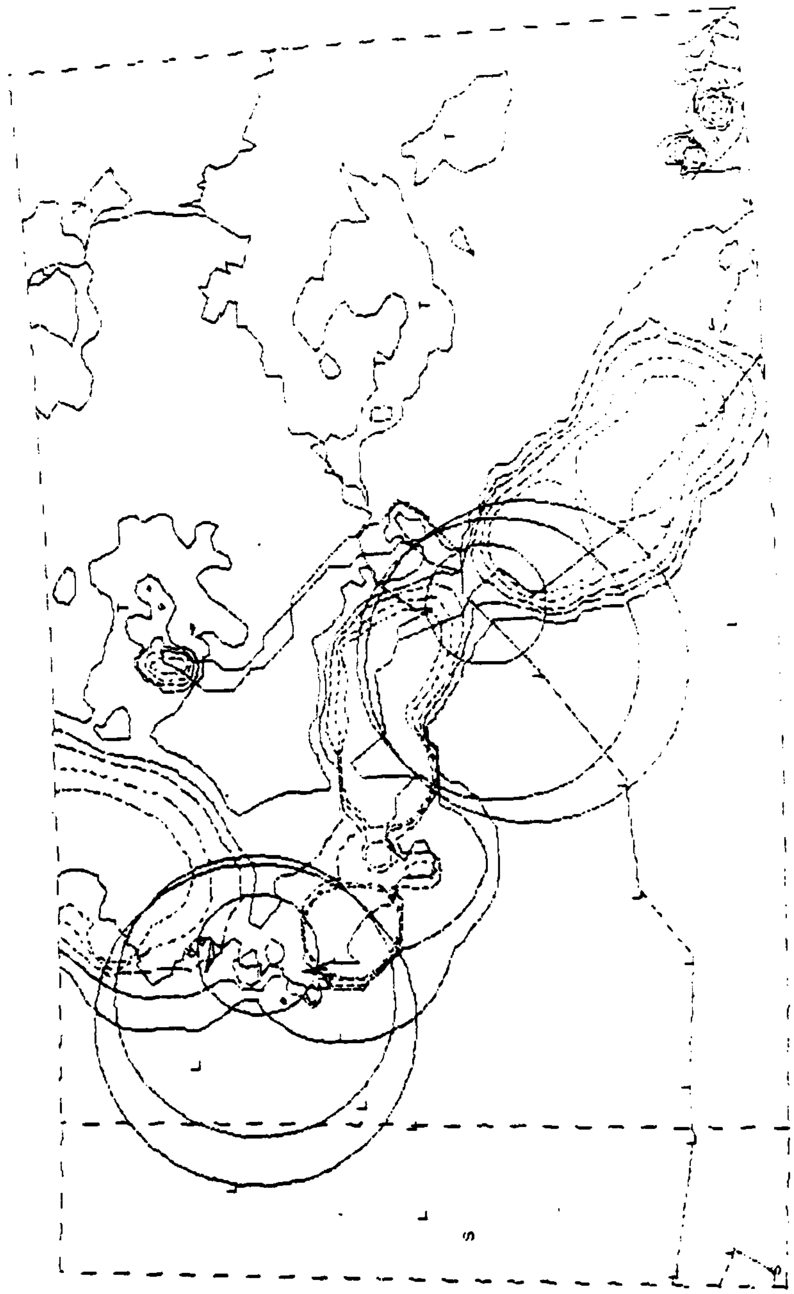


Figure V-15

(The user could restore the pre-suppression files at this time using the RESTORE command. He could then try a new set of suppressor locations. The current locations have successfully opened two corridors, however, no routes use the northern corridor. This is because all of the targets are accessible from the southern corridor and the southern routes have a higher survival rate than the northern ones.
The user would probably cancel the suppression assets at the northern corridor or reposition them with the other suppressors in the south. Instead, to demonstrate some more FLAPS features, the user will create a manual route that uses the northern corridor. First the user will rescale to the whole scenario and display all of the routes on the suppressed statespace in order to see the big picture (Figure V-16).)

: < DI SC SC >

: < DI M SU D RO / ALL 2 7 STAT D 7 >

```
CNTDGR--NH,NV,LVSEG,NVSEG,NAVE,LREAD=    73   109    19     6     8   584
         CPUTIM,WALLTIM,PAGEFLTS=      7.650     26.510     200.000
```

(The user does not like the fact that the northern most target is accessed through the southern corridor. Simply selecting another route (using the SELECT command) would not guarantee that it would use the northern corridor. Therefore, the user will create a manual route to the target. But, what target is it? This can easily be determined by using the FIND command.)

: < FIND >

CHOOSE A PARTICULAR TYPE OF ID YOU WANT TO FIND
THEN PLACE THE CURSOR CLOSE TO THE CENTER OF THE
OBJECT YOU WISH TO IDENTIFY

CHOOSE ONE: STGB(SB), TARGET(TG), LLTR(LL), THREAT(TH)
SUPPRESSOR(SU), COORDINATE(CO) OR ABORT(AB)

: < TG >

Hit SPACE BAR to continue, S to select new id type or A to abort

(The user wants to find a target. Once the cursor has been positioned using the thumbwheels on the desired target as shown in Figure V-17, the spacebar is depressed.)

: < spacebar >
ID = PRESCHEN AT 14.6500 LONG 51.6500 LAT

TARGET	STAGING BASE	AIRCRAFT ALLOCATED	WEAPON TYPE	PD ACHIEVED	ROUTE PS	ROUTE DIST (NM)
PRESCHEN	RAMSTEIN	2 F-16	MARK-20	0.900	0.33	709.8

Hit SPACE BAR to continue, S to select new id type or A to abort

(The desired target is PRESCHEN. Its sortie comes from RAMSTEIN. The user has forgotten where RAMSTEIN is, so the find command will be used again.)

: < S > (Indicate desire to select something else to find.)

CHOOSE ONE: STGB(SB), TARGET(TG), LLTR(LL), THREAT(TH)
SUPPRESSOR(SU), COORDINATE(CO) OR ABORT(AB)

: < SB >

(Select the find staging base option. Then move cursor to first RAMSTEIN position guess and hit the spacebar (see Figure V-18).)

Hit SPACE BAR to continue, S to select new id type or A to abort

: < spacebar >

ID = HAHN AT 7.2500 LONG 49.9330 LAT

TARGET	STAGING BASE	AIRCRAFT ALLOCATED	WEAPON TYPE	PD ACHIEVED	ROUTE PS	ROUTE DIST (NM)
PRAGUE	HAHN	4 F-16	AGM-65	0.999	0.39	661.3

Hit SPACE BAR to continue, S to select new id type or A to abort

(The user was wrong and found *HAHN* instead of *RAMSTEIN*. To try again, the cursor is simply repositioned (Figure V-19) and the spacebar is depressed again.)

: < spacebar >

ID = RAMSTEIN AT 7.5667 LONG 49.4330 LAT

TARGET	STAGING BASE	AIRCRAFT ALLOCATED	WEAPON TYPE	PD ACHIEVED	ROUTE PS	ROUTE DIST (NM)
PRESCHEN	RAMSTEIN	2 F-16	MARK-20	0.900	0.33	709.8
LEIPZIG	RAMSTEIN	4 F-16	AGM-65	0.999	0.37	695.7

Hit SPACE BAR to continue, S to select new id type or A to abort

(The user is through finding things, so the abort command is given)

< A >

CPUTIM,WALLTIM,PAGEFLTS= 0.460 118.689 12.000

(RAMSTEIN seems like a reasonable staging base to use for the PRESCHEN

sortie, so the user will create a manual route between them. In order to prepare for this, the screen is cleared of the suppressor location circles and all of the routes (Figure V-20).)

: < DI SU- RO- ' >

CPUTIM,WALLTIM,PAGEFLTS= 0.020 0.029 2.000

: < MA > (Signify manual route)

DO YOU WISH TO CONSTRUCT A NEW ROUTE OR CHANGE
THE WAYPOINTS OF A ROUTE IN THE SPED FILE?

TYPE IN "NEW", or A SPED RECORD or ID:

< NEW >

INPUT A STGB ID OR INDEX:

< RAMSTEIN >

INPUT A TARGET ID or INDEX:

< PRESCHEN >

(FLAPS draws a straight line from RAMSTEIN to PRESCHEN with a circle around RAMSTEIN (Figure V-21). The circled point is the selected waypoint. If the user types a D, the selected waypoint will be deleted from the route. If the user types a W, a waypoint will be added to the route after the selected waypoint wherever the cursor is positioned and the new waypoint will become the selected waypoint. The selected waypoint can be changed by moving the cursor to the waypoint you want to select and typing S.)

INGRESS WP = 1 LONG = 7.57 LAT = 49.43

Enter S to select, E for egress, I for ingress
W for add wp, D for delete, O for optimize
H for half optimize, F for finished, or A to abort

(The user wants to force the ingress path through the northern corridor. This is accomplished by using the half optimize command. When the cursor is positioned by an LLTR exit point and an H is entered, FLAPS finds the best path from the staging base to the LLTR exit point through the LLTR network and then draws a straight line from the LLTR exit to the target as shown in Figure V-22.)

: < H >

INGRESS WP = 1 LONG = 7.57 LAT = 49.43

Enter S to select, E for egress, I for ingress
W for add wp, D for delete, O for optimize
H for half optimize, F for finished, or A to abort

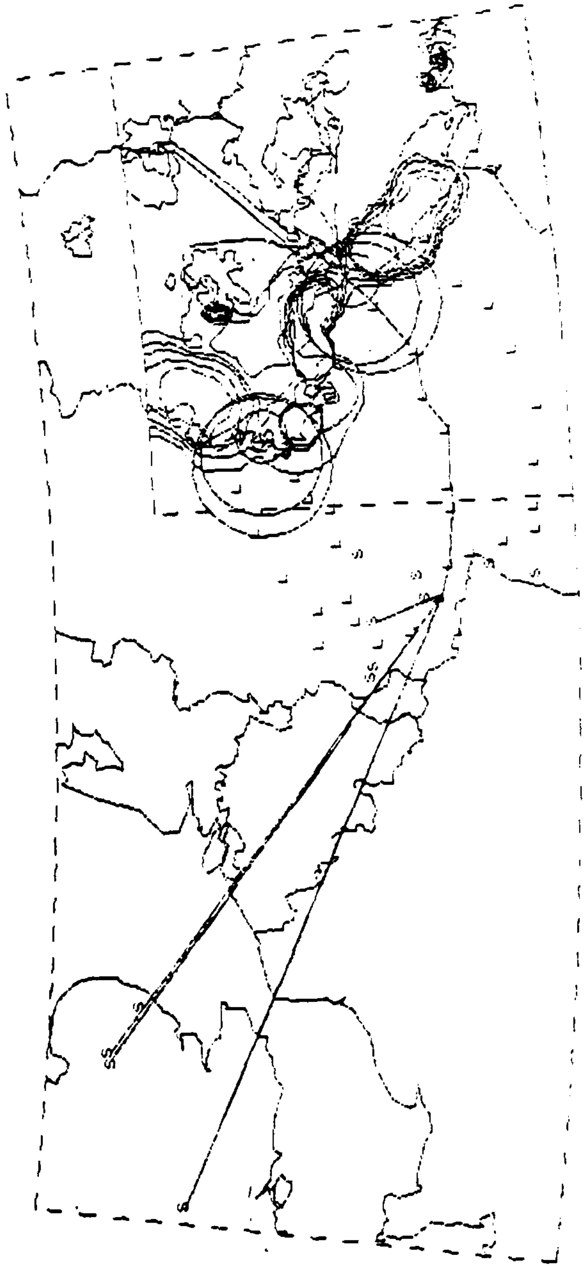


Figure V-16

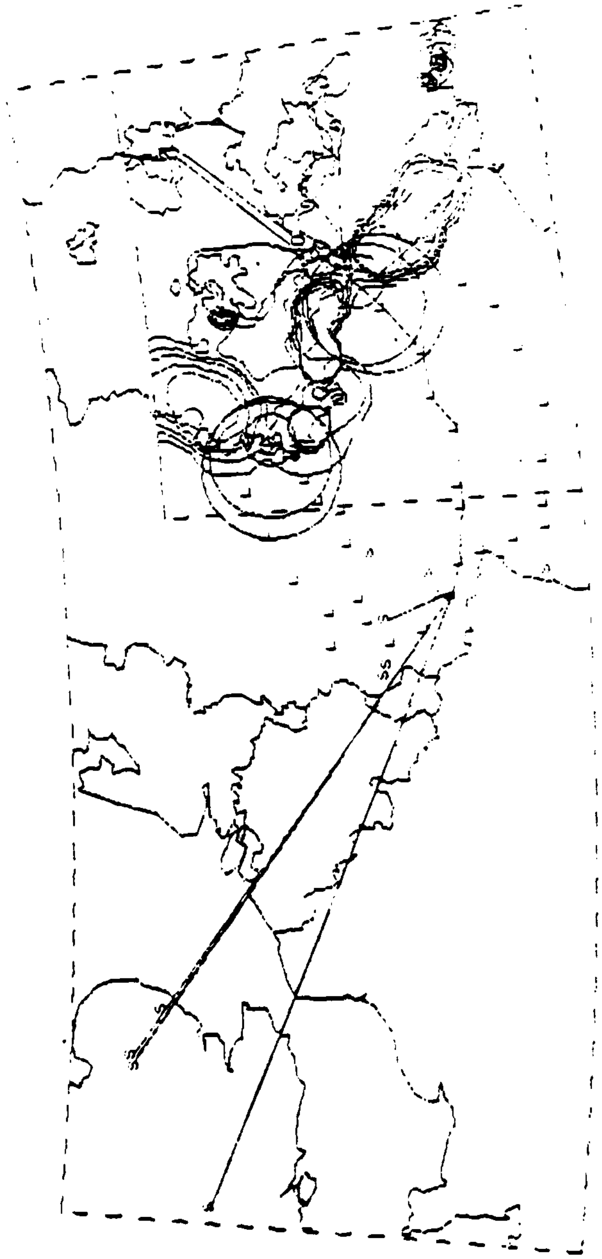


Figure V-17

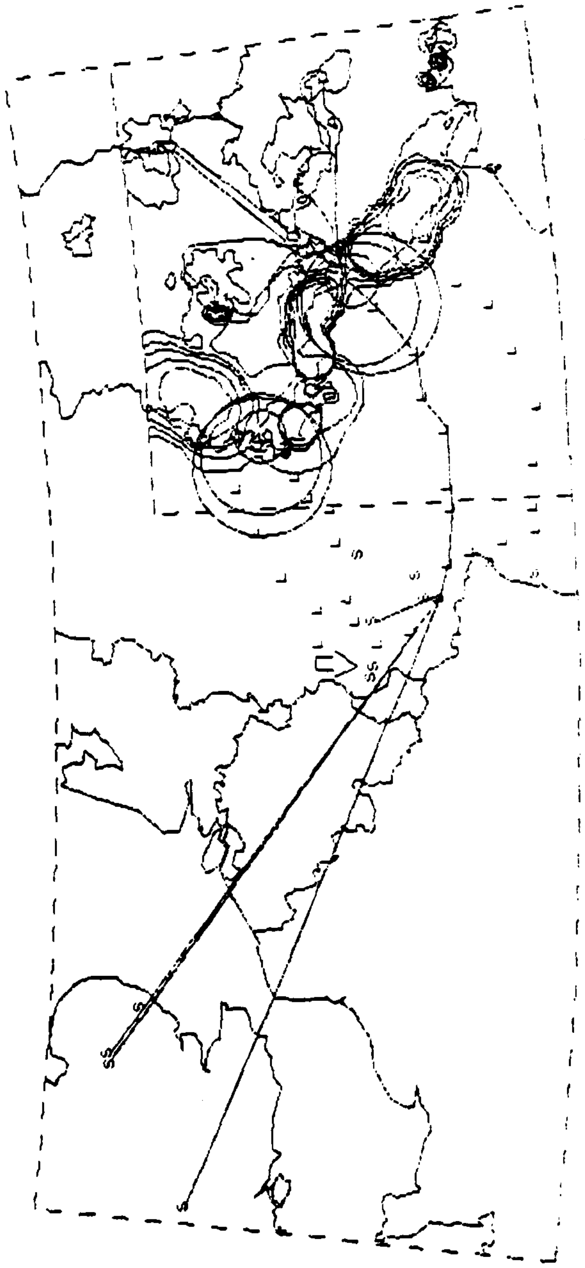


Figure V-18

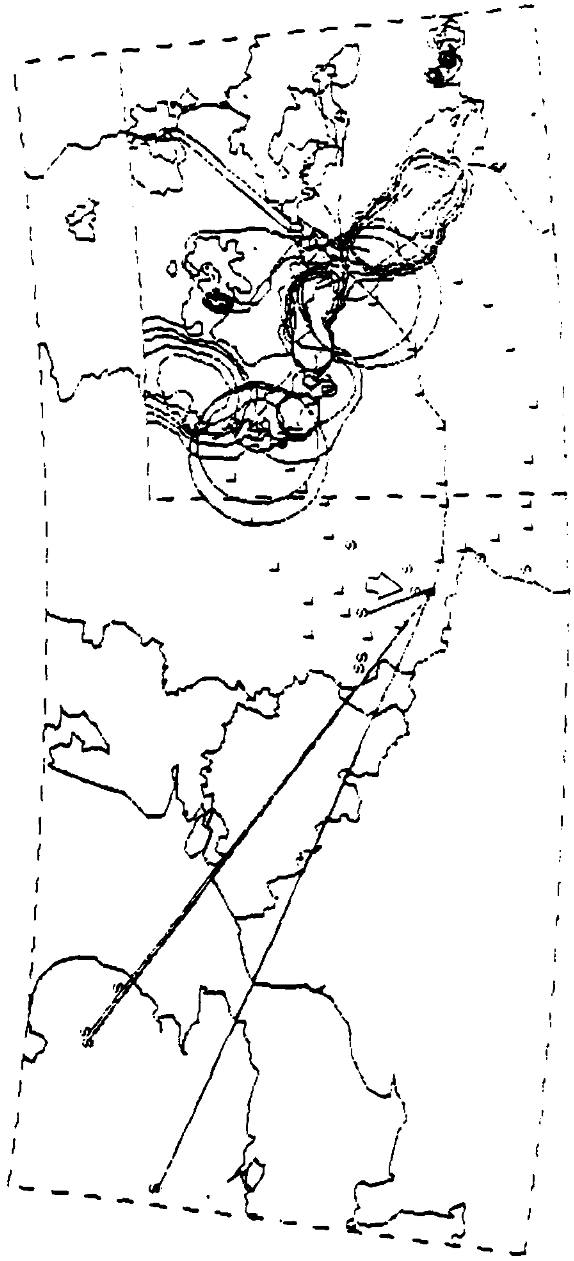


Figure V-19

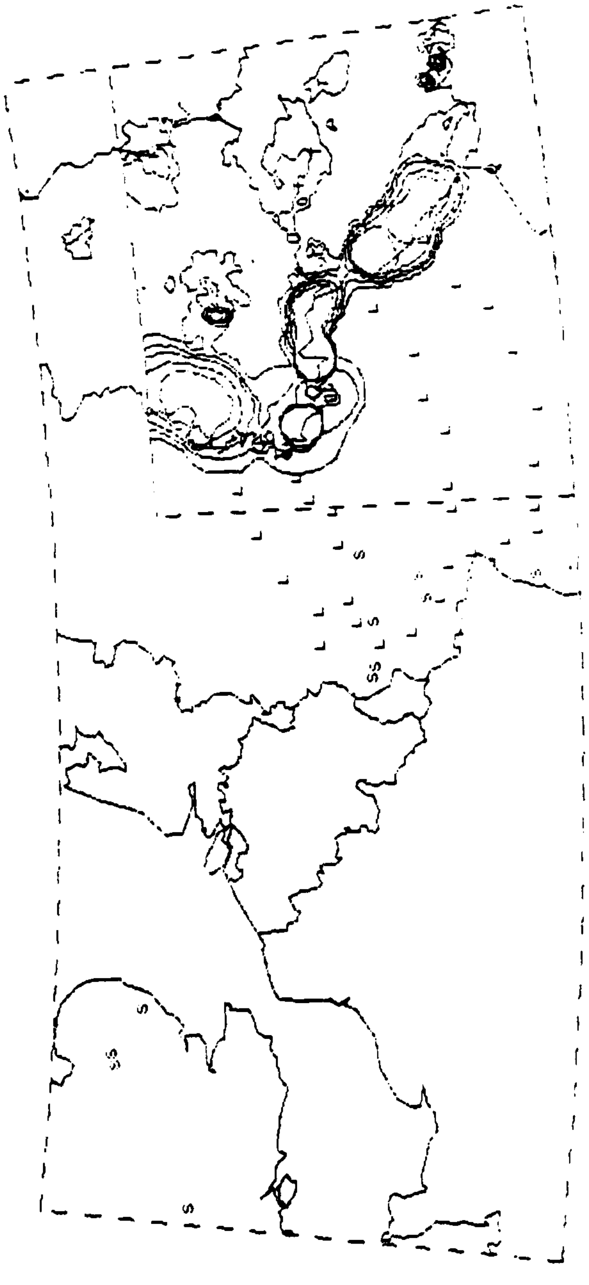


Figure V-20

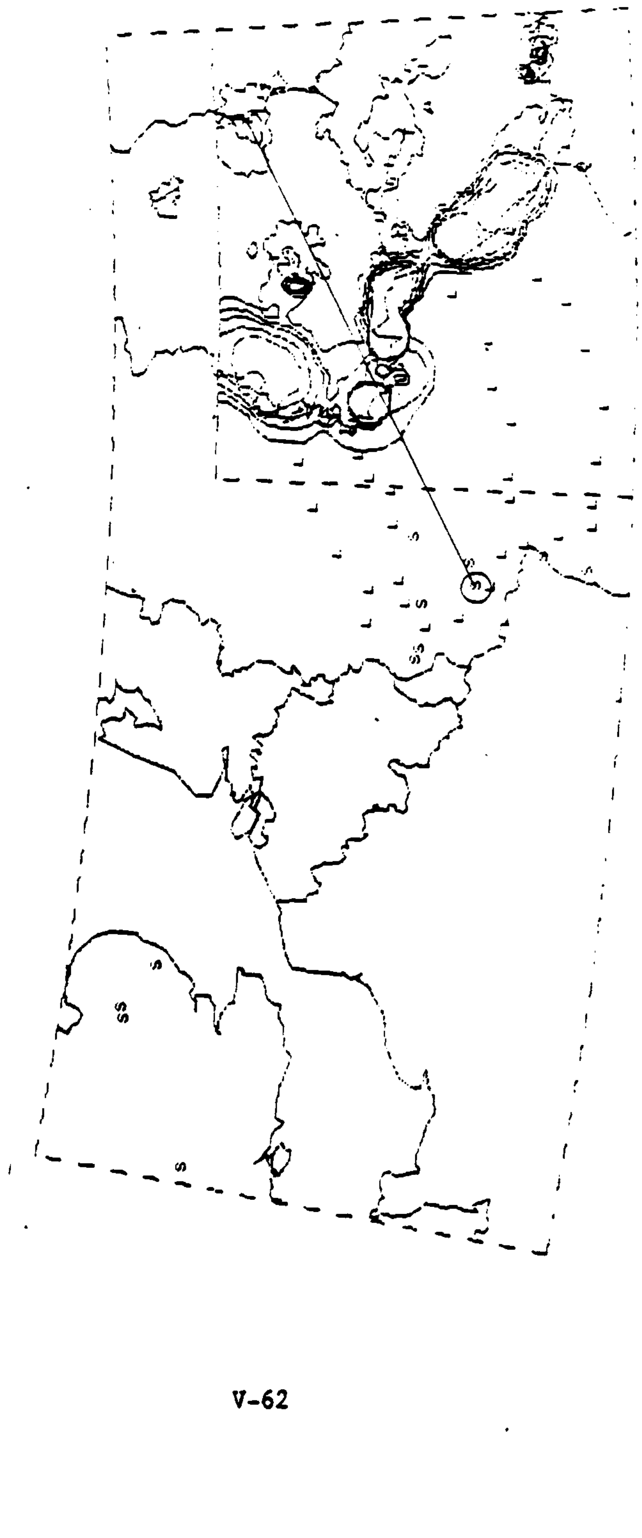


Figure V-21

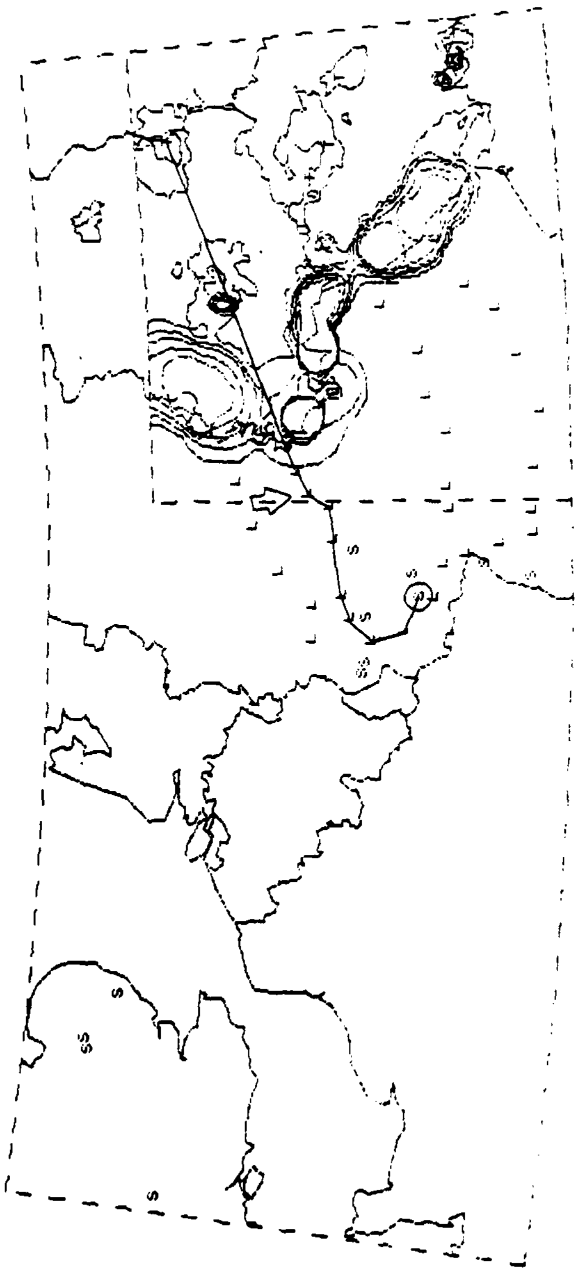


Figure V-22

(The staging base is still the selected waypoint. The user wants to add waypoints after the LLTR exit, so the LLTR exit must be made the selected waypoint. This is accomplished by moving the cursor to the LLTR exit and typing S (Figure V-23).)

```
:  < S >

  INGRESS     WP  =    9     LONG =  9.56     LAT = 50.60

  Enter S to select, E for egress, I for ingress
  W for add wp, D for delete, O for optimize
  H for half optimize, F for finished, or A to abort
```

(Now the user will add a waypoint in the corridor. This is done by positioning the cursor where the desired waypoint will be and typing W. Notice that the inserted waypoint becomes the selected waypoint (see Figure V-24).)

```
:  < W >

  INGRESS     WP  =   10     LONG =  9.92     LAT = 50.77

  Enter S to select, E for egress, I for ingress
  W for add wp, D for delete, O for optimize
  H for half optimize, F for finished, or A to abort
```

(The user will add another waypoint after the one just added. Since, the proper waypoint is selected, the user simply moves the cursor to the desired waypoint position and types W (Figure V-25).)

```
:  < W >

  INGRESS     WP  =   11     LONG = 11.28     LAT = 51.01

  Enter S to select, E for egress, I for ingress
  W for add wp, D for delete, O for optimize
  H for half optimize, F for finished, or A to abort
```

(The user wants to add one final waypoin, the results appear in Figure V-26.)

```
:  < W >

  INGRESS     WP  =   12     LONG = 12.56     LAT = 51.01

  Enter S to select, E for egress, I for ingress
  W for add wp, D for delete, O for optimize
  H for half optimize, F for finished, or A to abort
```

(The user is satisfied with the ingress half of the route. Typing E will let the user work on the egress half of the route. As Figure V-27 shows, a straight line is drawn from the target to the staging base with

the target circled to signify that it is the selected waypoint.)

```
:  < E >

  EGRESS      WP  =   13     LONG = 14.65     LAT = 51.65

  Enter S to select, E for egress, I for ingress
  W for add wp, D for delete, O for optimize
  H for half optimize, F for finished, or A to abort
```

(The user wants FLAPS to find the best egress path from the target to the staging base. This is accomplished by giving the optimize command. The results are shown in Figure V-28. Notice that FLAPS chose the southern corridor.)

```
:  < O >

  EGRESS      WP  =   13     LONG = 14.65     LAT = 51.65

  Enter S to select, E for egress, I for ingress
  W for add wp, D for delete, O for optimize
  H for half optimize, F for finished, or A to abort
```

(Finished building the route, the user types F and FLAPS saves it.)

```
:  < F >

  Enter a CHAR*12 ID, "/" for program selection or "AB"ort:
    < / >                               (FLAPS will name the route)

 MANUAL -- SELECTED ROUTE WRITTEN TO SPED: ID RAMSPRES02  RECORD      8
          CPUTIM,WALLTIM,PAGEFLTS=     3.040   160.070    34.000
```

(Now that the manual route is saved, the user can look at it just like any other route (Figure V-29).)

```
:  < DI RO / RAMSPRES02 >

          CPUTIM,WALLTIM,PAGEFLTS=     0.110     0.311     1.000
```

(The user can also show the plan for the manual route.)

```
:  < SH PLAN RAMSPRES02 >

 WRPLAN - FLIGHT PLAN FOR SORTIE: RAMSPRES02

 STAGING BASE RAMSTEIN (    8)  TO TARGET PRESCHEN ( 123)
 PROB OF SURVIVAL:    0.1044       THREAT PK:    0.8956
  FLIGHT DISTANCE:    715.41 NM
    TAKE OFF TIME:    0.0000  TIME ON TARGET:   45.3510     OF WAYPOINTS:   34
```

TIME (MIN)	LATITUDE (DMS)	LONGITUDE (DMS)	ALTITUDE (FEET)	HEADING (DEG)	NODE ID
0.000	49 25 59	7 34 00	197.18	296.49	RAMSTEIN
2.697	49 35 34	7 04 19	197.18	345.39	N031
4.993	49 53 18	6 57 09	197.18	39.23	N030
6.936	50 05 18	7 12 25	197.18	71.96	N023
9.198	50 10 53	7 39 12	197.18	83.42	N024
13.087	50 14 26	8 27 23	197.18	80.96	N025
15.601	50 17 35	8 58 22	197.18	25.18	N026
17.290	50 29 46	9 07 23	197.18	70.01	N027
19.514	50 35 50	9 33 38	197.18	52.32	N028
21.678	50 46 23	9 55 13	197.18	74.36	
28.376	51 00 45	11 16 51	197.18	90.00	
34.416	51 00 45	12 33 27	197.18	63.85	
45.351	51 39 00	14 38 60	197.18	241.87	PRESCHEN
45.750	51 37 30	14 34 29	197.18	180.00	
46.689	51 30 00	14 34 29	197.18	225.89	
56.987	50 32 30	13 01 08	197.18	270.00	
57.297	50 32 30	12 57 15	197.18	224.75	
58.620	50 24 60	12 45 35	197.18	180.00	
58.933	50 22 30	12 45 35	197.18	224.80	
59.374	50 19 60	12 41 41	197.18	135.18	
59.816	50 17 30	12 45 35	197.18	180.00	
60.129	50 15 00	12 45 35	197.18	224.90	
61.013	50 09 60	12 37 48	197.18	198.42	
62.004	50 02 30	12 33 55	197.18	270.00	
62.630	50 02 30	12 26 08	197.18	228.00	
66.034	49 44 18	11 54 50	197.18	233.66	S092
70.334	49 23 55	11 12 16	197.18	264.90	S091
73.757	49 21 29	10 30 30	197.18	232.16	S086
76.459	49 08 14	10 04 26	197.18	272.52	S085
80.220	49 09 33	9 18 35	197.18	265.43	S082
82.200	49 08 18	8 54 31	197.18	277.31	S081
86.132	49 12 17	8 06 54	197.18	285.49	S080
88.479	49 17 17	7 39 15	197.18	338.57	S079
89.651	49 25 59	7 34 00	197.18	338.57	RAMSTEIN

CPUTIM,WALLTIM,PAGEFLTS= 0.280 3.121 24.000

(After seeing that the probability of survival for the FLAPS planned route is about three times higher than for the manually planned route, the user in this example is now happy with the FLAPS routes and is ready to end the current session. Before quitting, the user decides to display the Weapons Free Zones (Figure V-30).)

: < DI P / > (Clear the display)

CPUTIM,WALLTIM,PAGEFLTS= 2.210 3.240 0.000

: < DI M WF / > (Display the Weapons Free Zones)

CPUTIM,WALLTIM,PAGEFLTS= 3.930 5.301 0.000

(Oops! One of the expected Weapons Free Zones is missing. Someone forgot to put it in the data base. The FLAPS results obtained so far are still good since Weapons Free Zones are currently used only for display purposes and hence are not used in any calculations. The user could enter the missing Weapons Free Zone textually, but chooses to enter it graphically instead. This is accomplished with the DRAW command.)

: < DRAW >

DO YOU WISH TO BUILD A WFZ(W) or ROZ(R) POLYGON?:

: < W >

MOVE CURSOR TO BOUNDARY POINT CLOCKWISE

Hit SPACE BAR to continue, F if finished
D to delete last line or A to abort

(The user moves the cursor to the first vertex of the Weapons Free Zone as shown in Figure V-31.)

: < space bar >

MOVE CURSOR TO BOUNDARY POINT CLOCKWISE

Hit SPACE BAR to continue, F if finished
D to delete last line or A to abort

(The user moves the cursor to the second vertex and pushes the space bar. FLAPS connects the two vertices (Figure V-32).)

: < space bar >

MOVE CURSOR TO BOUNDARY POINT CLOCKWISE

Hit SPACE BAR to continue, F if finished
D to delete last line or A to abort

(The user moves the cursor to the third vertex and hits the space bar. FLAPS adds the second line to the first (Figure V-33).)

MOVE CURSOR TO BOUNDARY POINT CLOCKWISE

Hit SPACE BAR to continue, F if finished
D to delete last line or A to abort

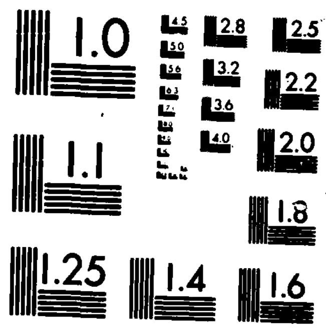
(The Weapons Free Zone is finished, so the user types F. Figure V-34 shows the completed Weapons Free Zone.)

: < F >

(FLAPS prompts the user for the name of the new Weapons Free Zone.)

AD-A165 583 FORCE LEVEL AUTOMATED PLANNING SYSTEMS (FLAPS) USER'S MANUAL(U) SYSTEMS CONTROL TECHNOLOGY INC PALO ALTO CA S RAINBOLT ET AL. FEB 86 F61546-84-C-0008 4/4

UNCLASSIFIED F/G 15/7 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

```
ENTER A CHAR*8 ID or "AB"ort:

  < OCTOPUS >                          (The WFZ is named OCTOPUS)

         CPUTIM,WALLTIM,PAGEFLTS=     0.170   119.920     3.000
```

(To make sure that the Weapons Free Zone has been added correctly, the user shows its record.)

```
:  < SHOW WFZ OCTOPUS / >

 CRSHOW -- RECORD      5    IDWORD=OCTOPUS
          ID  =     OCTOPUS
          NPTS=           3
          X   = 9.7738E+00 4.9974E+01 9.3970E+00 4.9761E+01
                9.9203E+00 4.9628E+01 0.0000E+00 0.0000E+00
                0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
                0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
                0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
          IDC =     86/01/01 12:12
          IDM =     86/01/01 12:12
          CPUTIM,WALLTIM,PAGEFLTS=     0.050     0.598     1.000
```

(The missing Weapons Free Zone has been added correctly. The user is finished. To end the current session, the user enters QUIT.)

```
: < QU >
```

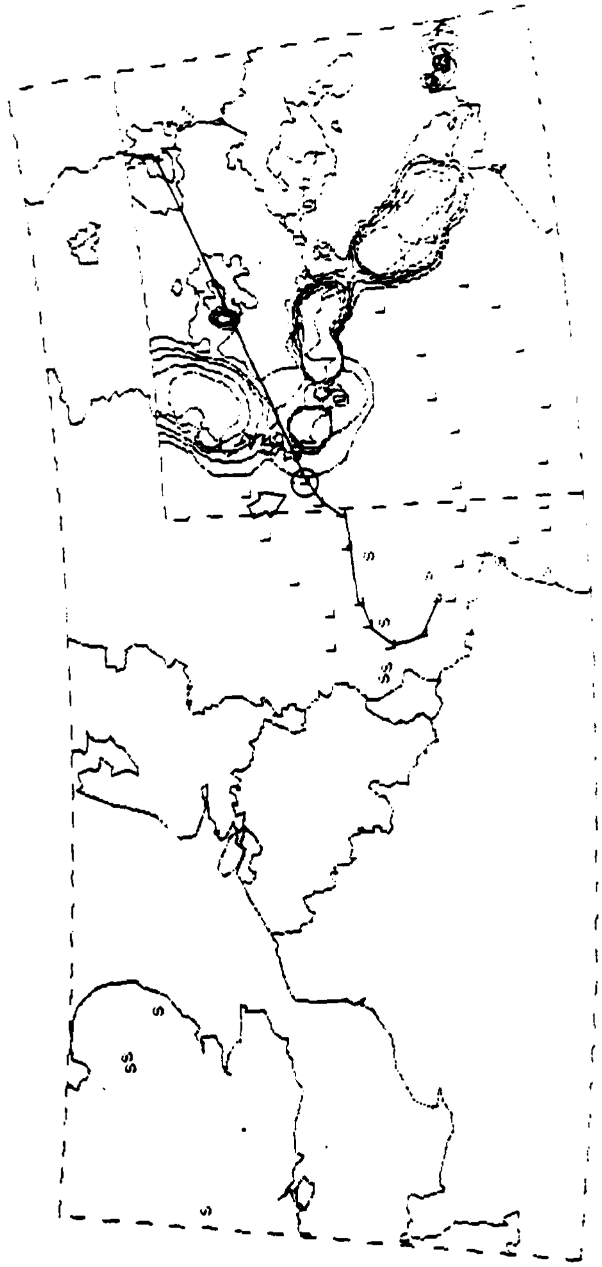


Figure V-23

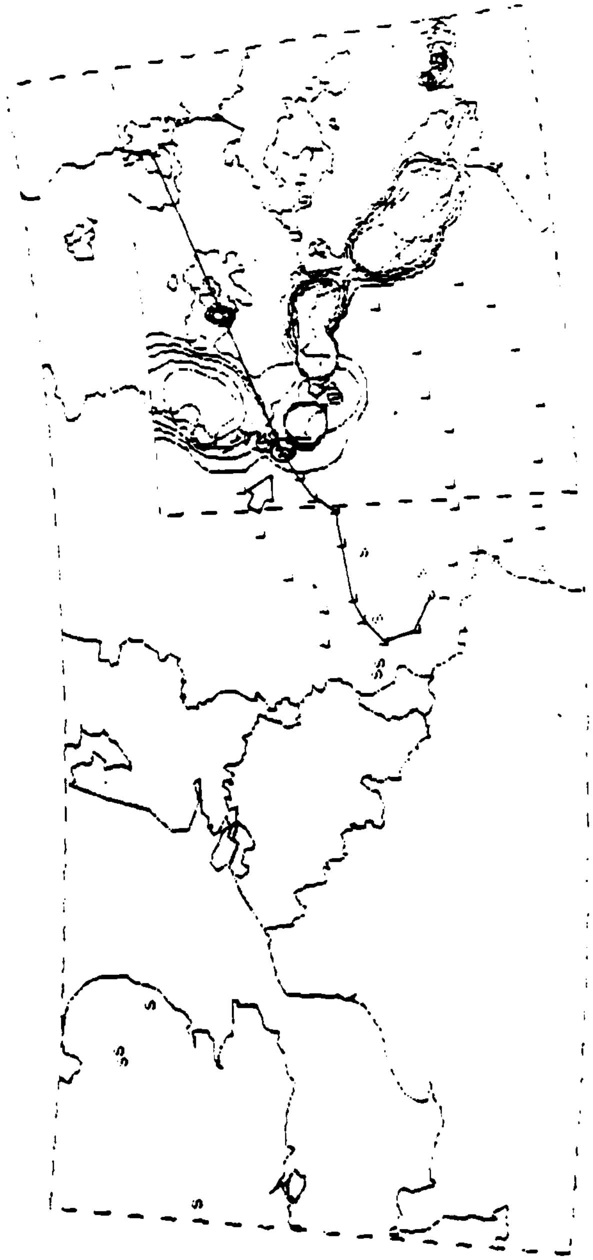


Figure V-24

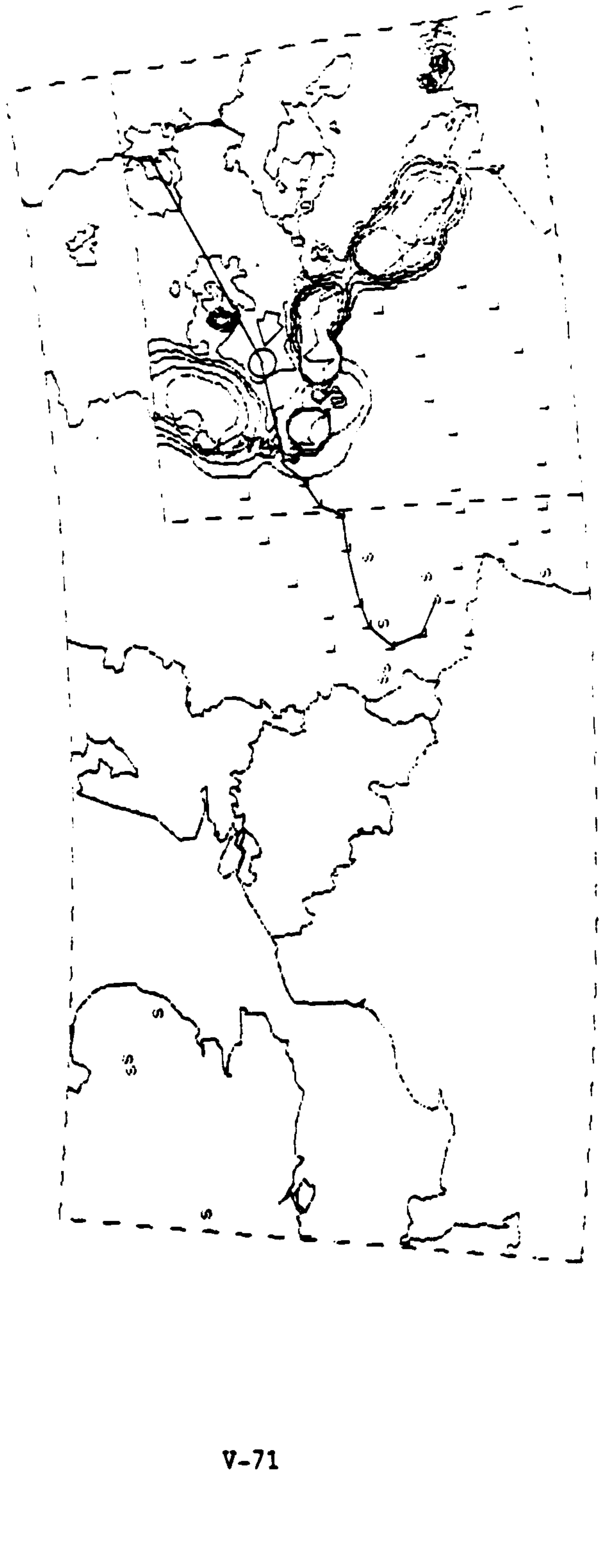


Figure V-25

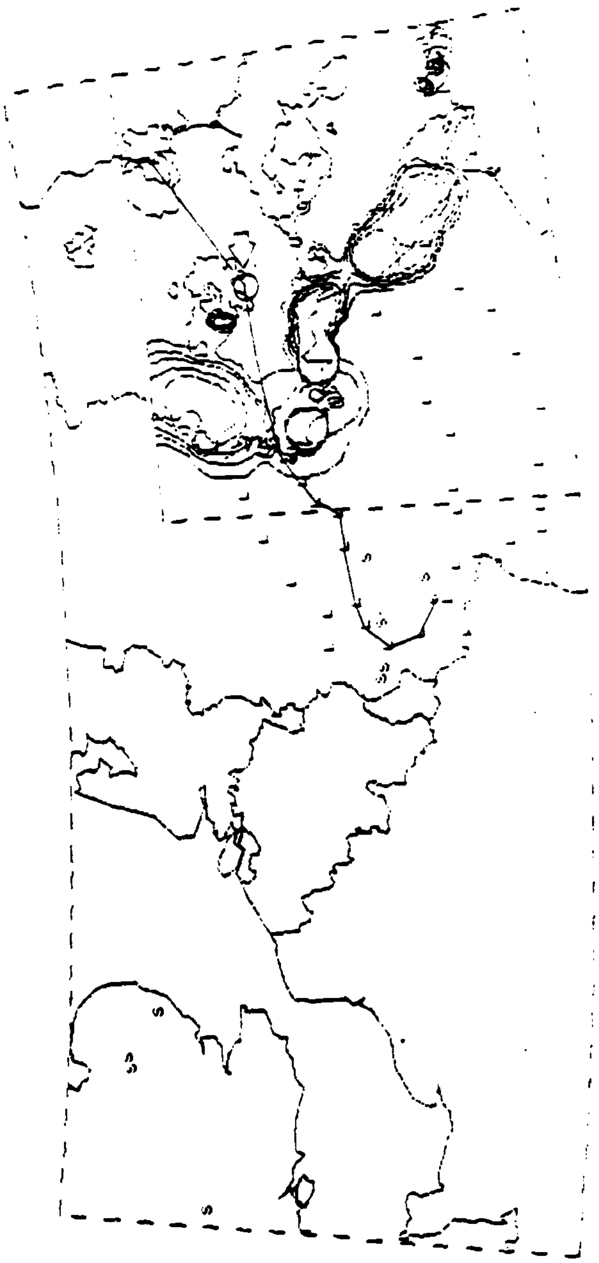


Figure V-26

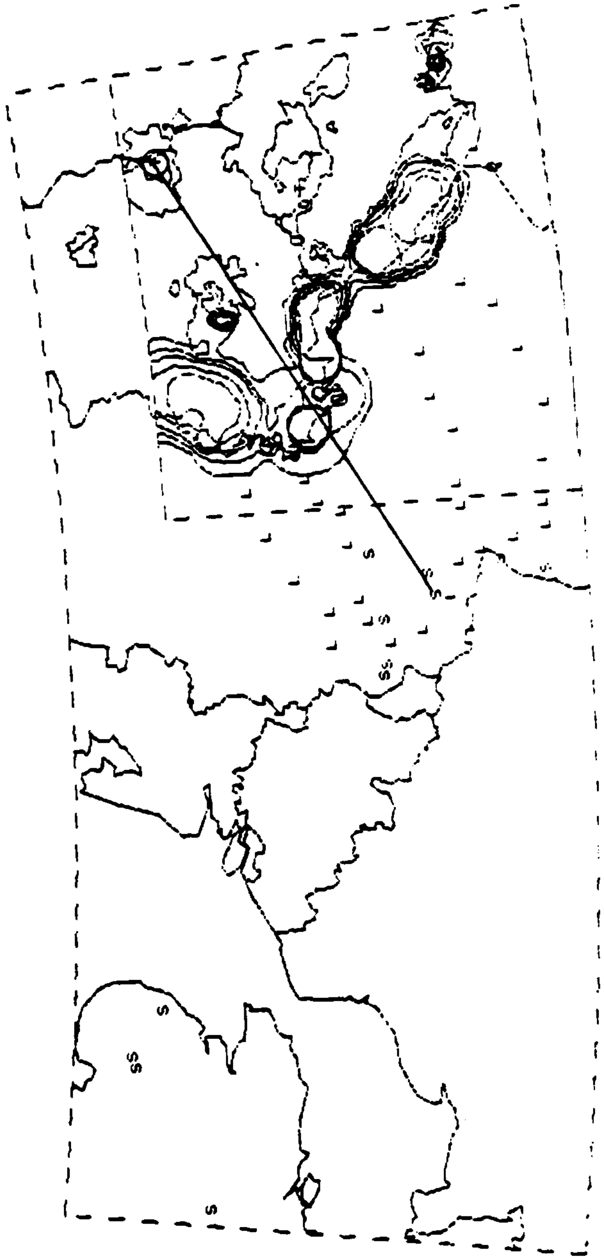


Figure V-27

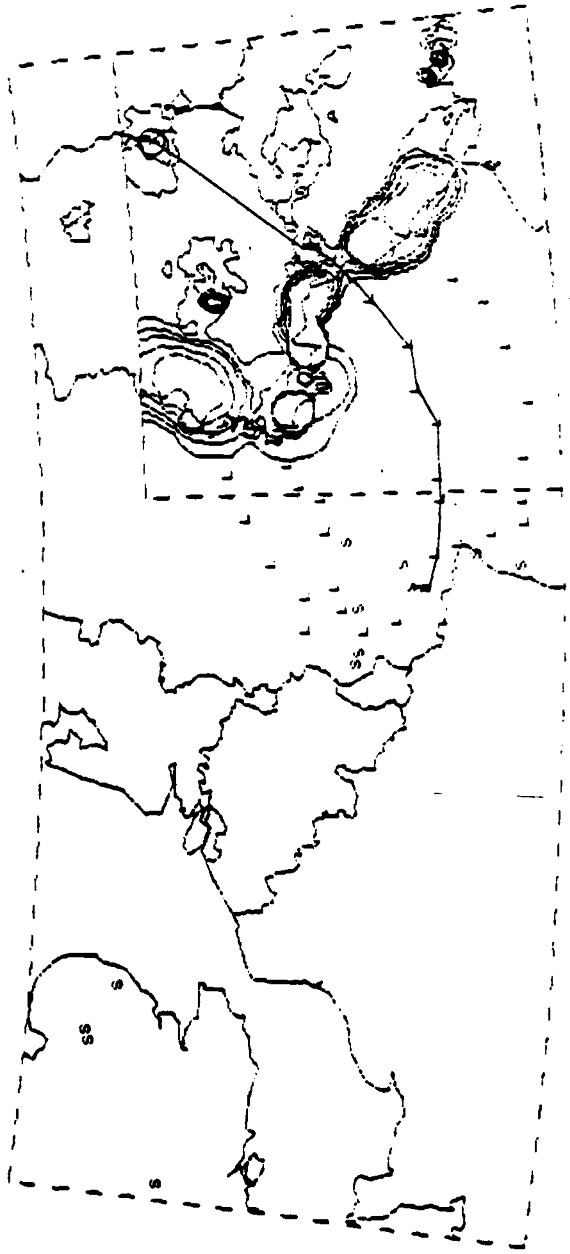


Figure V-28

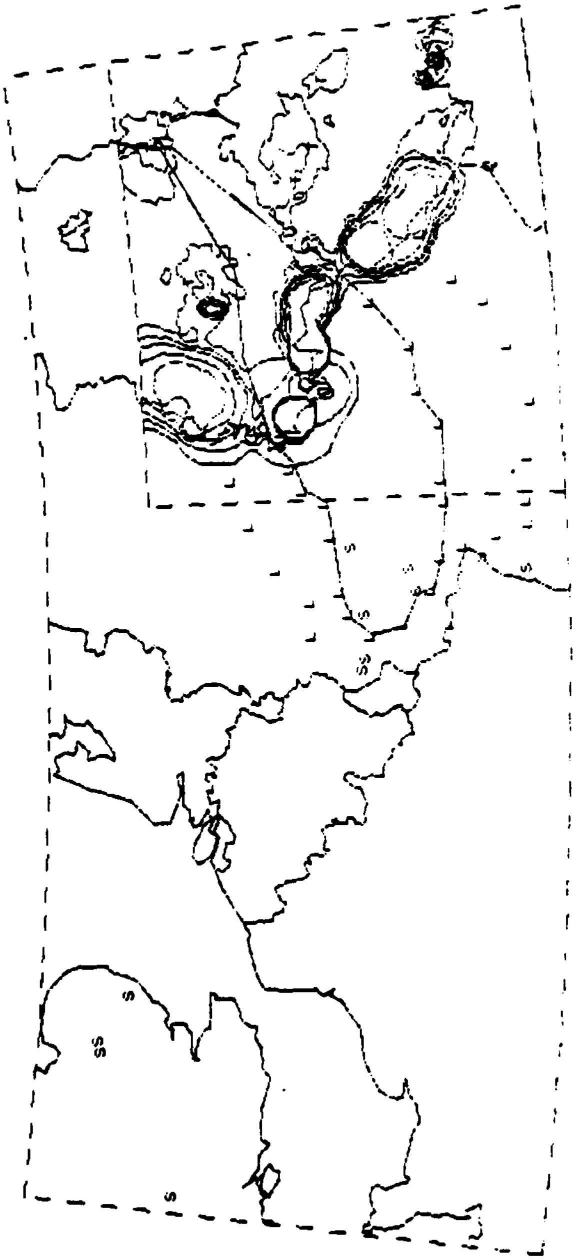


Figure V-29

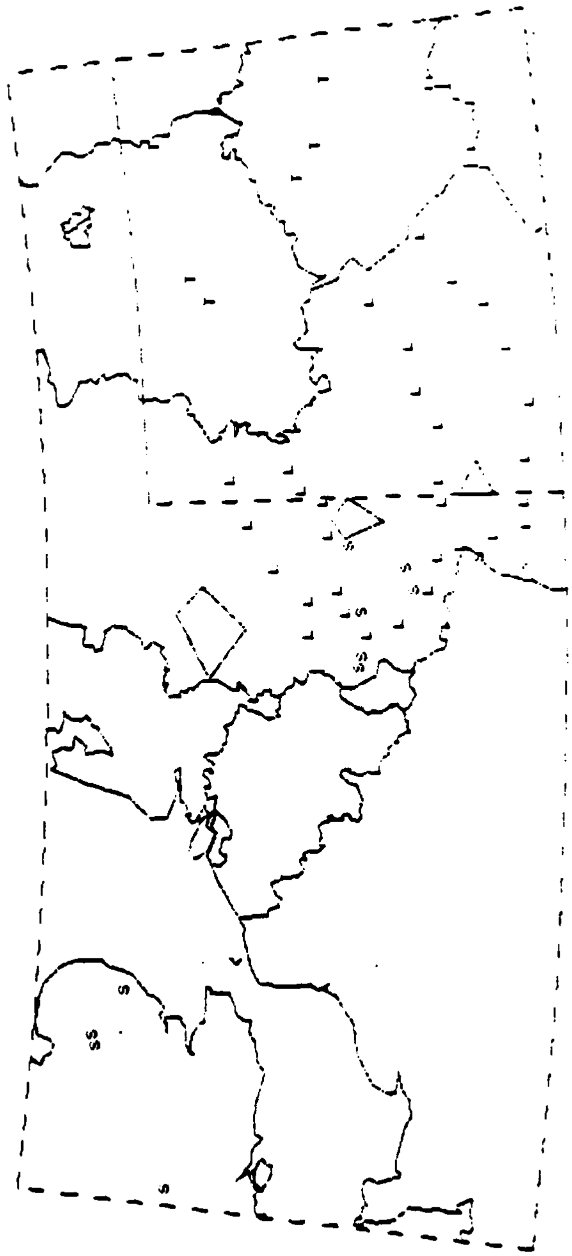


Figure V-30

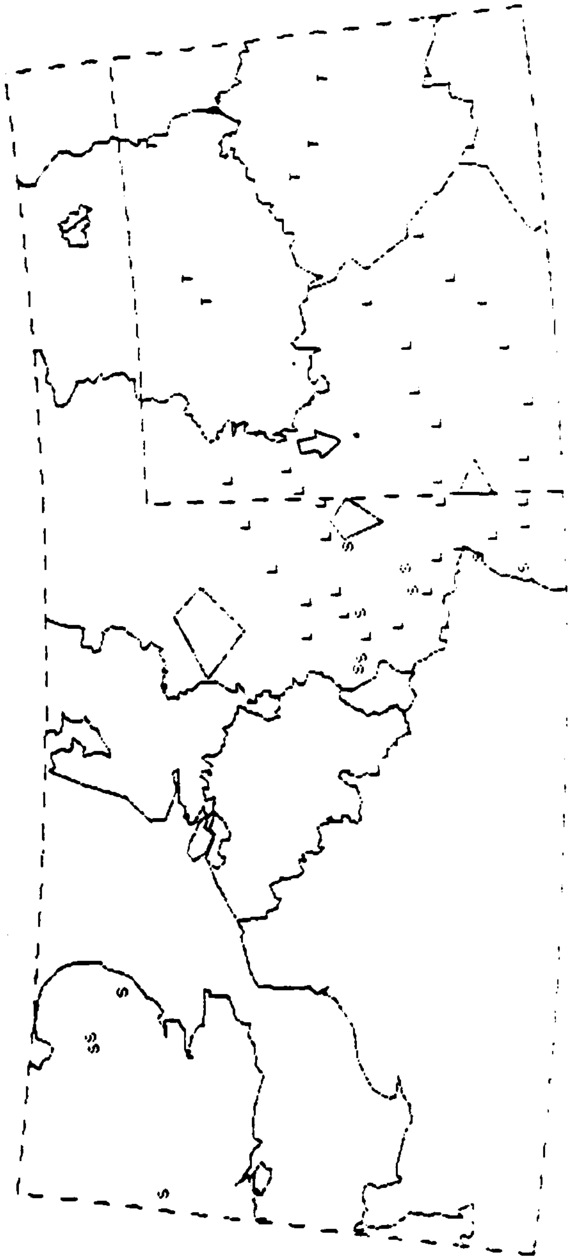


Figure V-31

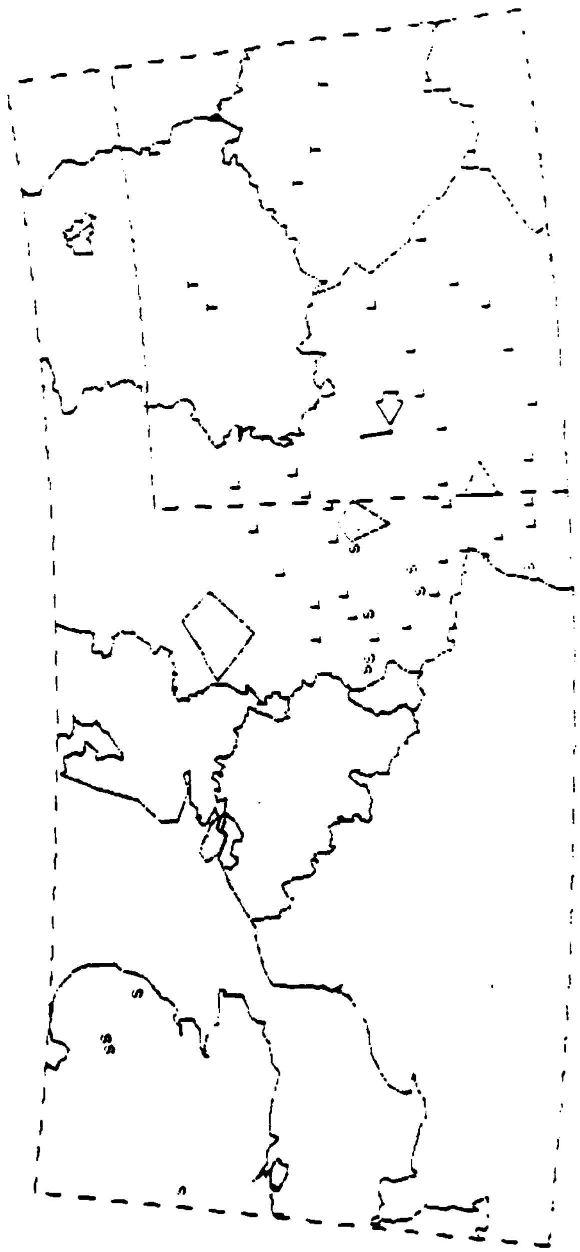


Figure V-32

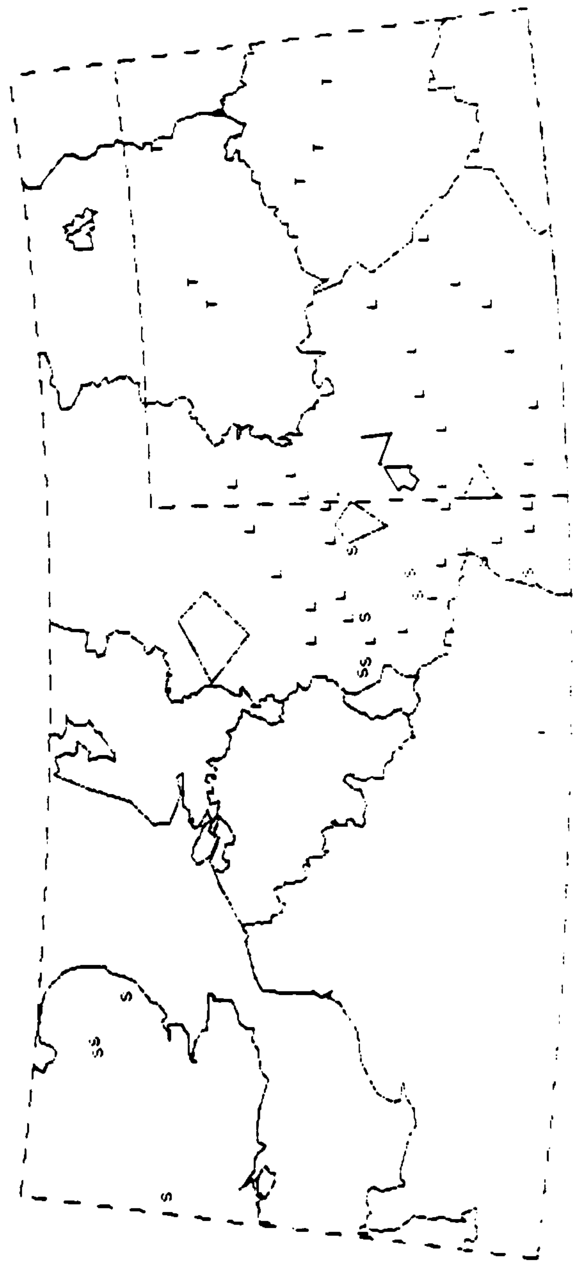


Figure V-33

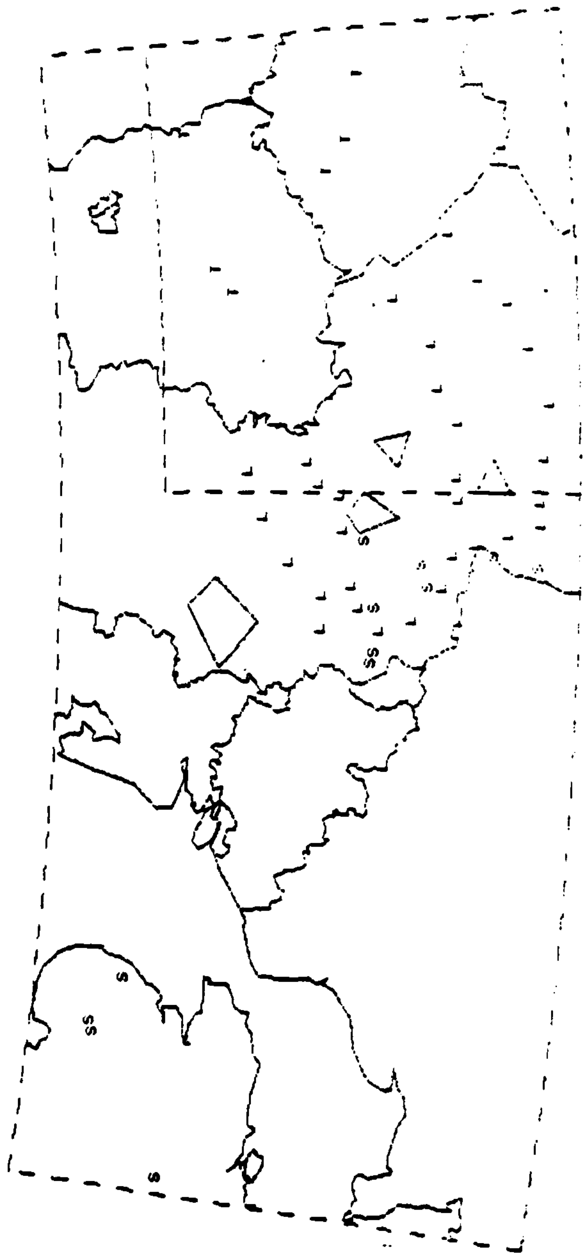


Figure V-34

APPENDIX A

HOW TO SET UP AND RUN FLAPS

A.1 INTRODUCTION

As Systems Control Technology develops updated versions of FLAPS, it will be necessary to install the new versions of FLAPS on your computer. This appendix contains the information needed to install a new version of FLAPS when the update tape arrives from SCT. Once the directory architecture and LOGIN.COM are set up, installing the updated FLAPS and all future updated versions of FLAPS is a simple process.

The FLAPS update tape contains seven different labeled areas. These areas are stored as a seperate DCL BACKUP "SAVESET". After setting the directories described below, the user should load these files onto his or her system using the DCL BACKUP command.

Each saveset area contains important information that must be loaded in the correct directory of your computer in order for FLAPS to work properly. The next section explains how to set up these directories. The following is an explanation of the names of the seven areas and what they contain.

SOURCE.BCK is the area that contains the FLAPS source code. These are FORTRAN-77 files whose names end in ".FOR" (the ".FOR" part is called the file's extension). The FLAPS executable file is also in this area. Its name is FLAPS.EXE.

COMMON.BCK is the area that contains the FLAPS commons. These are special FORTRAN files that contain memory shared by several FLAPS subroutines. All of the common files have a ".CMN" extension.

EUROPE.BCK is the area that contains the files necessary to run the FLAPS European scenario. The European scenario is the area that runs from 48 N to 53 N in latitude and 2 W to 18 E in longitude. Also in this area are the Z series of initialization command files for the European scenario. Their use is explained in Appendix C. Normally the user will never have to worry about the Z series of files since the other files in this area contain the same information already processed into a form that FLAPS understands. The Z series files all have a .DAT extension. The FLAPS data files have a ".FIL" extension.

LIBYA.BCK is the area that contains the files necessary to run the FLAPS Libyan scenario. The Libyan scenario is the geographic area that runs from 25 N to 53 N in latitude and from 15 W to 30 E in longitude. As in EUROPE.BCK, this area contains the Z series of ".DAT" command files and the FLAPS ".FIL" files.

SCILIB.BCK is the area that contains the system library routines that drive certain FLAPS processes, for example, the FLAPS graphics. If these files are not loaded into the proper directory, the user will be unable to link FLAPS and create an executable image (FLAPS.EXE).

DTED.BCK is the area that contains the Defense Mapping Agency Digitized Terrain Elevation Data (Level 1) which is used by FLAPS to do terrain masking of threats in the European scenario. Currently, the Libyan scenario uses a "bald earth" model because the DTED which it requires is not yet available. When it is obtained, it will be included in the DTED.BCK area. DTED files have a ".ZOT" extension.

A.2 SOFTWARE CONFIGURATION

Simply understanding the contents of an SCT FLAPS update tape is not enough if one has the goal of loading and using the tape. The computer onto which the tape is being loaded must have a directory configuration suitable to receive the data from the tape. While there are many ways of setting up suitable directories, the approach described below is a useful way to avoid confusion. This section discusses the directories necessary to run FLAPS, and how to set up these areas.

A.2.1 Directory Architecture

Figure A-1 shows the directory architecture necessary to run FLAPS properly. It consists of a main directory with three sub-directories. For the purpose of this discussion, the main directory will be called FLAPS. Although you need not call your main directory FLAPS, it is recommended that you do, since this will make your system match the comments in this appendix. Regardless of what you call your main directory, it must have three sub-directories called COMMON, EUROPE, and LIBYA. A directory is an area in the computer where logical groupings of files are stored. A sub-directory is a directory that is contained inside of another directory. The exact

sub-directory name is made by concatenating the main directory name with that of the sub-directory. Therefore, the actual name of the COMMON sub-directory (if FLAPS is the name of the main directory) would be FLAPS.COMMON. Each of the directories must have specific parts of the tape loaded into them. The following is an explanation of what must be loaded where.

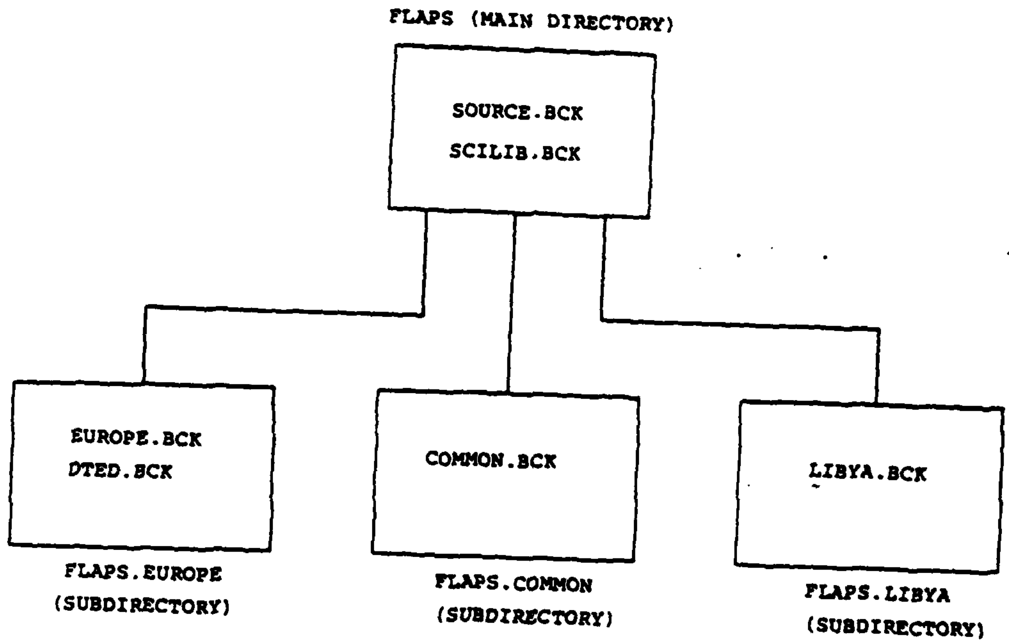


Figure A-1 The FLAPS Directory Architecture

FLAPS is the main directory. It is the area that must contain the FLAPS source code, executable, and system libraries. Therefore, all of the information in the SOURCE.BCK and SCILIB.BCK, areas of the SCT FLAPS update tape must be loaded into the FLAPS main directory.

FLAPS.COMMON is the sub-directory where the common files are to be kept. FLAPS will expect these files to be there whenever its code is recompiled. If it does not find them, then error messages will result and FLAPS will not work properly. All of the files in the COMMON.BCK area of the FLAPS update tape must be loaded into the FLAPS.COMMON sub-directory.

FLAPS.EUROPE is the sub-directory a user must be in to run the European scenario. All of the files in the EUROPE.BCK area of the FLAPS update tape must be loaded into the FLAPS.EUROPE sub-directory. Additionally, since the European scenario of FLAPS uses DTED for terrain masking, all of the files in the DTED.BCK area of the update tape must be loaded into this sub-directory.

FLAPS.LIBYA is the sub-directory where a user must be in to run the Libyan scenario. All of the files in the LIBYA.BCK area of the FLAPS update tape must be loaded into the FLAPS.LIBYA sub-directory.

A.2.2 LOGIN Initialization

Now that you understand the need for these different directories, you are probably wondering how you can set them up. If FLAPS has already been installed on your computer, then they have probably already been established. If so, you can skip this section. Otherwise, read on.

Directories are created by using the create directory command. When your account is established, it will have only one directory and that will have the name of your account. When you create a directory, it becomes a sub-directory of the directory you are in.

Therefore, if your account was named FLAPS, this would be perfect. You would simply have to log on and you would be in the FLAPS directory. While in the FLAPS directory, if you issued the following commands, you would set up the directory structure FLAPS needs to operate.

```
CREATE/DIRECTORY [FLAPS.COMMON]
CREATE/DIRECTORY [FLAPS.EUROPE]
CREATE/DIRECTORY [FLAPS.LIBYA]
```

As mentioned previously, your main directory does not have to be named FLAPS. Whatever name you choose for your main directory will need to be substituted for FLAPS in the above directory commands, as well as any following ones. For example, if you call your main directory BRUCE, the command to create the COMMON sub-directory would be:

```
CREATE/DIRECTORY [BRUCE.COMMON]
```

There is a file called the LOGIN.COM file which permits a user to customize an account by giving special names to various frequently executed commands. Every time you log onto your account, the LOGIN.COM command file is executed. Any special function commands that are defined in this file will then be available to you for the rest of your session.

In order to make your FLAPS sessions easier, add the following short-cut command lines to your LOGIN.COM file.

To display the name of the directory you are in, add the following SD (Show Directory) command to your LOGIN.COM file:

```
$ SD:==SHOW DEF
```

Whenever you are unsure of the directory you are in, simply type "SD" after the dollar sign prompt and the directory name will be displayed.

Next, expedite moving from one directory to another by adding the following lines:

```
$ EUROPE:==SET DEF [FLAPS.EUROPE]
$ LIBYA:==SET DEF [FLAPS.LIBYA]
$ COMMON:==SET DEF [FLAPS.COMMON]
$ MAIN:==SET DEF [FLAPS]
```

Once this is done, typing the word to the left of the colon (i.e. EUROPE) in response to the dollar sign prompt, will place you in its corresponding directory.

The reason that MAIN was used in the above example, is that there is a special use for word FLAPS. Add the following line to your LOGIN.COM file.

```
$ FLAPS:==RUN/NODEBUG [FLAPS]FLAPS
```

This way, whenever you type FLAPS to the dollar sign prompt, you will run the FLAPS program.

After you are finished with your LOGIN.COM file, you can execute it by logging off and then logging back on, or by typing "@LOGIN" <cr>. This will set up the command words. From now on, whenever you log into the VAX, these command words will be automatically set.

A.2.3 A Normal FLAPS Run

Now that your LOGIN.COM has been initialized and your directories have been set up, you should load the update tape savesets into their proper directories using the DCL BACKUP command. After that, you are ready to run FLAPS. This is where setting up your LOGIN.COM pays off.

Before you can run, you must be in the sub-directory of the scenario which you want to run. To get there, simply type the name of the desired scenario in response to the dollar sign prompt. For example, if you wanted to run the European scenario, type "EUROPE". Although you do not have to, if you would like to verify that you are now in the correct directory, type "SD".

Finally, to run, simply type "FLAPS" in response to the dollar sign prompt. Once inside FLAPS, typing "QU" to the colon prompt will end the FLAPS session.

APPENDIX B

HOW TO RECOMPILE THE SOURCE CODE

B.1 INTRODUCTION

A FLAPS user should never have to recompile code. It is possible to get into a lot of trouble if one does not do the recompilation process correctly. For this reason, the FLAPS update tapes that you will receive from SCT already have the compilation process completed. By following the directions in Appendix A, you will be able to run FLAPS.

However, in the interest of completeness, and recognizing that an emergency situation may arise requiring the recompilation of code, we have included this appendix. An example of the type of emergency that would require recompilation would be a case where the FLAPS program does not run properly, the solution to the problem is known, but there is not time to send a tape from SCT. Assuming the problem can be solved by correcting one or two lines of code, the user could correct the problem (as instructed by SCT engineers) and then recompile the code. This would permit the user to continue operations until a FLAPS update tape arrives.

B.2 PROCEDURE

This procedure assumes that your computer is set up as described in Appendix A. If this is not the case, then you must read Appendix A and follow the procedures to set up the files for FLAPS before proceeding.

Once the set up is complete, you are ready to make your one line code fix. This should only be done with the approval of an SCT engineer. SCT cannot be held responsible for any code changes made without their approval. Since the source code is kept in the main directory (FLAPS in Appendix A), you must be in the main directory to change the code and perform all of the other steps in this appendix. You can determine which directory you are in by typing "SD" to the dollar sign prompt. If you are not in the main directory, you can get there by typing "MAIN" to the dollar sign prompt.

The user will make the needed corrections using the VAX text editor. After the code has been fixed, the user may either recompile all of the code or recompile only the affected subroutines. To recompile all of the code, the user should type "@FORLIS" after the dollar sign prompt. This will execute a command file called FORLIS.COM (FORTRAN compile and source listing) in the main directory. Remember that FORLIS.COM recompiles every FLAPS subroutine.

To recompile an individual subroutine, the user types:

FORTRAN/NOOP/DEBUG/LIST <subroutine name (no extension)> <cr>

The user should use the debug (DEBU) and no-optimize (NOOP) suboptions, as shown above. The listing (LIST) suboption is not necessary. The user may wish to define a FORTRAN compile command word in his or her LOGIN.COM file as follows:

```
F:==FORTRAN/NOOP/DEBUG/LIST
```

Using this command word (or letter), the compile command would look like this:

```
$ F <subroutine name (no extension)>
```

Once all of the routines have been recompiled, it is necessary to place them into an object library. In this case, the object library is named FLAPS.OLB. If the user is recompiling all of the routines, the BLDLIB.COM command file should be used. However, before you can use it on your computer, you will have to edit the BLDLIB.COM file and remove the following line.

```
$ SET DEFAULT [FLAPS.CURCODE]
```

In addition, you should delete any existing FLAPS.OLB files that exist in the main directory and create a new one. The old FLAPS.OLB is deleted using the DCL DELETE command. The new version is created by typing:

```
$ LIB/CREATE FLAPS.OLB
```

The BLDLIB.COM file can then be executed by typing "@BLDLIB" to the dollar sign prompt.

If the user is only compiling an individual routine, the FLAPS.OLB file does not need to be created from scratch; the existing one can be modified. To do this type:

```
$ LIB/REPLACE FLAPS <subroutine name (no extension)>
```

Now that the library has been built or modified, the final step is to link the object library with the system library. This is accomplished with the help of the FLAPS.COM command file. Once again, the command file must be alterred before you can use it on your system. First, you must remove the following line:

```
$SET DEF [FLAPS.CURCODE]
```

Then, you will have to change the line that says

```
DRA0:[SCI.LIB]SCILIB/LIB
```

so that it says

```
SCILIB/LIB
```

The easiest way to accomplish this is simply to delete the DRA0:[SCI.LIB] part of the line.

After the FLAPS.COM file has been altered, you will be able to execute it by typing "@FLAPS" to the dollar sign prompt. When the FLAPS.COM file finishes its execution, you will be able to run FLAPS in the normal manner (as described in Appendix A).

It is sometimes necessary to relink the program without doing a recompile. This is the case when differences in VAX/VMS operating systems at different installations cause the FLAPS executable not to run. To relink, the user must execute the FLAPS.COM command file as described above. The user should make sure that the FLAPS.COM file is consistent with the directory names he or she is using. The user should also make sure that the FLAPS object library FLAPS.OLB is in the main FLAPS directory. The FLAPS.OLB object library is delivered in the SOURCE.BCK area of the update tape.

B.3 A SAMPLE FLAPS.COM COMMAND FILE

The FLAPS.COM command file links the FLAPS object library with the system library creating a FLAPS.EXE file. Whether you are recompiling code or simply relinking, the following is a sample FLAPS.COM file that will work for you. Note that this is what the FLAPS.COM file that comes on your FLAPS update tape will look like after the changes described in the previous section have been made.

```
$ !
$ ! PROC TO LINK ALL ROUTINES IN FLAPS
$ !
$LINK/DEBU/MAP/FULL/CROSS_REFERENCE FLAPS/LIB/INCLUDE=(FLAPS,FLPBLK),-
 SCILIB/LIB
$ !
```

APPENDIX C

HOW TO BUILD FILES FROM SCRATCH

C.1 INTRODUCTION

A FLAPS user should never have to build data files from from scratch. This is another area where it is possible to get into a lot of trouble quickly if the process is done incorrectly. For this reason, the FLAPS update tapes that you receive from SCT will have all of the files built for both of the scenarios (European and Libyan). By following the directions in Appendix A, you will be able to run FLAPS using the files on the update tape.

An example of a time when files might have to be rebuilt is hard to imagine. In a FLAPS session, if a user wishes to replace part of the data base he or she may delete the undesired records in a file (table) and then replace them with new records. For example, if the user needed a different target set, then all of the targets in the TG table should be deleted and the new targets added, either by hand or from a command file. This would be faster and less work than rebuilding all of the files from scratch.

Still, it is possible to think of extreme situations which necessitate the building of files from scratch. (A user may destroy all of the files accidentally, only to discover that the latest FLAPS update tape is either unavailable or has been destroyed.) Therefore, we are including the directions which one must follow when building files.

C.2 PROCEDURE

This procedure assumes that your computer is set up as described in Appendix A. If this is not the case, then you must read Appendix A and follow the procedures for setting up the computer for FLAPS.

The procedure for building files from scratch is the same whether you are building files for the European or Libyan scenarios. The sub-directory in which you are working determines the scenario which you will build. Thus, if you want to build the European scenario, you must type "EUROPE" to the dollar sign prompt before beginning. This will place you in the EUROPE sub-directory. Typing "LIBYA" will place you in the LIBYA sub-directory so that you can build files for the Libyan scenario. For the purposes of this example, the rest of this appendix will use the European scenario as its sample case. Examples of each of the command files for the European scenario together with a brief explanation of what each does, appear in the last section of this appendix.

Before building new files, it is a good idea to verify that you are in the correct sub-directory. This can be done by typing "SD" to the dollar sign prompt. If you are in the wrong sub-directory, for the scenario you are trying to build, go back and repeat the previous paragraph.

Now it is time to start building new files. You will have to make three separate FLAPS runs before the new files will be in a condition that they can be used normally. Failure to make any of the three runs correctly, or making the runs in the wrong order, will guarantee that FLAPS will not work properly. If that should happen, rebuild the files making sure that all of the instructions are being followed. Before beginning the first run, take a moment and verify that rebuilding these files is really necessary.

The first run initializes the table structures. Type "FLAPS" to the dollar sign prompt to begin the session. FLAPS will ask you if you want to have a normal session. Type "NO" and then type "READ ZDEFINE.DAT YES" to the colon prompt. When FLAPS is finished reading this file, it will give you a colon prompt. You are finished with the first run, so type "QUIT".

The next run initializes the array structures. Type "FLAPS" to the dollar sign prompt to begin the session and then type "NO" to indicate that this is not a normal run. To the colon prompt type "READ ZDEFAR.DAT YES". When FLAPS is finished reading this file, it will give you another colon prompt. Typing "QUIT" will end the session.

The third, and final run is the most complex. It is also the most time consuming. The amount of time that it takes varies depending on what scenario you are building and what type of computer you are using. Budget at least an hour and a half for this run; it may take longer.

The third run initializes the data base. Type "FLAPS" to the dollar sign prompt to begin the session and then type "NO" to indicate that this is not a normal run. To the colon prompt type "READ ZOPEN.DAT YES". This will open all of your new files. When FLAPS is finished reading the file, it will give you another colon prompt to which you must type "READ ZINIT.DAT YES". When you get another colon prompt, type "READ ZDEMO.DAT YES". This is a long file that initializes all of the tables. After the tables are built, you must instruct FLAPS to build the arrays. The command for this is "PROCESS" followed by a carriage return. Then type "1" followed by another carriage return. FLAPS will calculate the statespace, nodes, accessibility, arcs and routes. When it is finished, it will give you another colon prompt. Type "SELECT ALL" to write the routes to the SPED file. You will then be ready to type "QUIT" and end the session.

At this point, you have built new files from scratch. You can now do normal runs by following the directions in Appendix A. It would be a good idea to test your files by trying to do a normal run. If this work, then clean up the old files by typing "PURGE *.FIL" to the dollar sign prompt.

C.2.1 SAMPLE COMMAND FILES

The remainder of this appendix contains the most important and frequently used FLAPS command files. The first three command files are used to initialize the FLAPS data base manager. The normal user should never have to use these files. The next three files define the scenario. This is the same scenario which was used to generate the examples in Chapter V. The following is a brief description of each command file and its use. They are listed in the order in which they are normally run when building files from scratch. With the

exception of ZCONTNU.DAT, a user should not have to use any of these files during a normal run. In fact, since the use of ZCONTNU.DAT is now transparent to the user, that is the user sees only the results of running the file and neither initializes nor sees the process of the run itself, persons desiring to perform a normal FLAPS run need not concern themselves with the following files.

```
 ZDEFINE.DAT  ------------  Initialize Table Structures
  ZDEFAR.DAT  ------------  Initialize Array Structures
   ZOPEN.DAT  ------------  Open and Initialize Tables and Arrays
   ZINIT.DAT  ------------  Initialize the Scenario (ALGP)
   ZDEMO.DAT  ------------  Enter Scenario Data Base
 ZCONTNU.DAT  ------------  Begin Standard Run
```

C.2.2 The ZDEFINE.DAT Command File

The ZDEFINE.DAT command file is the first command file read when initializing FLAPS. A FLAPS user will probably never have to use this command file.

The ZDEFINE.DAT command file defines the structure of all of the FLAPS tables. The following is a sample of a ZDEFINE.DAT command file.

```
;
;      STRUCTURE TABLE
;
OPEN TSTR NEW TSTR.FIL  R/W
SHOW TSTR HELP
ABOR
;
;     DEFINE ASTR STRUCTURE
;
 ADD TSTR ASTR 60 0 5 "ARRAY STRUCTURE         "
  NAMA NXRC ITIT IDC IDM /
  CHO4 INT CH24 TIME TIME /
  1 1 1 1 1 /
  "ARRAY NAME             "
  "MAX NUMBER OF RECORDS  "
  "TITLE OF ARRAY         "
  "RECORD CREATION DATE   "
  "RECORD MODIFICATION DATE" /
```

```
 /
 0 0 0 -5 -5 /
 0 0 0 0 0 /
 0 0 0 0 0 /
 0 0 0 0 0 /
 /
;
;    DEFINE ALGP STRUCTURE
;
ADD TSTR ALGP 3 0 21 "ALGORITHM PARAMS       "
 ID DELE DELN XMIN XMAX YMIN YMAX NALT NDIR IDUM
 IDVE ARMX FLAM ALTS XSCL XSCU YSCL YSCU PCAP IDC
 IDM /
 CH04 REAL REAL REAL REAL REAL REAL INT INT INT
 CH04 REAL REAL REAL REAL REAL REAL REAL REAL TIME
 TIME /
 1 1 1 1 1 1 1 1 1 1
 1 1 1 5 1 1 1 1 5 1 1
 1 /
 "ID = ALGP               "
 "LONGITUDE GRID(NM)      "
 "LATITUDE GRID(NM)       "
 "MIN LON OF STATESPACE   "
 "MAX LON OF STATESPACE   "
 "MIN LAT OF STATESPACE   "
 "MAX LAT OF STATESPACE   "
 "NUMBER OF ALTITUDES     "
 "NUMBER OF DIRECTIONS    "
 "  OF MASKING POINTS     "
 "VEHICLE NAME FOR STATES "
 "LAMDA - AIR DAMAGE      "
 "LAGRANGE MULTIPLIER     "
 "ALTITUDE GRID (M)       "
 "MIN LON OF SCENARIO     "
 "MAX LON OF SCENARIO     "
 "MIN LAT OF SCENARIO     "
 "MAX LAT OF SCENARIO     "
 "PROB OF CLOBBER GRID    "
 "RECORD CREATION DATE    "
 "RECORD MODIFICATION DATE" /
 /
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0 -5 -5
-5  /
 0  1  1  1  1  1  1  1  0  0
 0  0  0  1  1  1  1  1  1  0
 0  /
 A  0.0  0.0  -180  -180  -90  -90  1  1  0
 A  0.0  0.0  0.0   -180 -180 -90 -90  0.0 0
 0  /
 0  99.0  99.0  180  180  90  90  10  8  50
 999  0  0  45000.0  180 180 90 90 .0001 0
```

```
 0   /
 /
;
;    DEFINE CMDL STRUCTURE
;
ADD TSTR CMDL 3 100 21 "CLOBBER MODEL          "
 ID ISE1 ISE2 CLO1 CLO2 CLOK CLK1 CLK2 PCMA DUM1
 DUM2 DUM3 DUM4 DUM5 ULF PCS CONS COSI COMX IDC
 IDM /
 CH04 INT INT REAL REAL REAL REAL REAL REAL REAL
 REAL REAL REAL REAL REAL REAL REAL REAL REAL TIME
 TIME /
 1 1 1 1 1 1 1 1 1 1
 1 1 1 1 3 12 33 33 33 1
 1 /
 "ID OF VEHICLE          "
 "RANDOM   SEED          "
 "RANDOM   SEED          "
 "FULL GLOAD PARAMETER   "
 "GLOAD SLOPE PARAMETER  "
 "ROUGHNESS PARAMETER    "
 "CLOB BREAK PT PARAMETER "
 "CLOB SLOPE PARAMETER   "
 "MAX PROB OF CLOBBER    "
 "DUMMY NOT USED YET     "
 "DUMMY NOT USED YET     "
 "DUMMY NOT USED YET     "
 "DUMMY NOT USED YET     "
 "DUMMY NOT USED YET     "
 "DIV LINES LO FACTOR BAND"
 "DIV LINES PROB BWEEN BAN"
 "CONS IN HC EQ FOR BAND  "
 "COEF SIGRH HC EQ 4 BAND "
 "COEF MXMX2 HC EQ 4 BAND "
 "RECORD CREATION DATE   "
 "RECORD MODIFICATION DATE" /
 /
 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 -5
 -5 /
 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0
 0 /
 A 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0
 0 /
 ZZZZ 9999 9999 9999 9999 9999 9999 9999 9999 9999
 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
 9999 /
 201 900 900 900 900 900 900 900 900 900
 900 900 900 900 900 900 900 900 900 900
 900 /
```

```
;
;     DEFINE CURR STRUCTURE
;
ADD TSTR CURR 3 600 24 "CURRENT STATUS        "
 ID IADD IALT IAOP ICLO ISTO ILST INDX IPRO ITYP
 IMSK IDEV IDM1 IDM2 IDM3 IDM4 IDM5 IDM6 IDM7 IDM8
 IDM9 IDM0 IDC IDM /
 CH04 INT INT INT INT INT CH04 INT INT INT
 INT CH04 INT INT INT INT INT INT INT INT
 INT INT TIME TIME /
 1 1 1 1 1 1 1 1 1 1
 1 1 1 1 1 1 1 1 1 1
 1 1 1 1 /
 "ID = CURR                "
 "  OF THREATS ADDED       "
 "TERRAIN ALT INIDCATOR    "
 "ALTITUDE LEVEL           "
 "CLOBBER INDICATOR        "
 "  OF STCH THREATS ADDED  "
 "LAST COMMAND GIVEN       "
 "INDEX OF LAST ARC DONE A"
 "STATUS OF PROC COMMAND   "
 "TYPE OF LAST ARC DONE A "
 "  OF THREATS MASKED      "
 "DEVICE CHARACTER         "
 "DUMMY NOT YET USED       "
 "DUMMY NOT YET USED       "
 "DUMMY NOT YET USED       "
 "DUMMY NOT YET USED       "
 "DUMMY NOT YET USED       "
 "DUMMY NOT YET USED       "
 "DUMMY NOT YET USED       "
 "DUMMY NOT YET USED       "
 "DUMMY NOT YET USED       "
 "DUMMY NOT YET USED       "
 "RECORD CREATION DATE     "
 "RECORD MODIFICATION DATE" /
 /
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0
 0  0 -5 -5  /
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  /
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  /
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0 /
 /
;
```

```
;     DEFINE DISP STRUCTURE
;
ADD TSTR DISP 6 600 39 "DISPLAY PARAMS          "
 IDEV LMIN MMIN LMAX MMAX XSCL YSCL XSUB YSUB XMIN
 YMIN XMAX YMAX IMIN JMIN IMAX JMAX XLB1 DXLB NXLB
 YLB1 DYLB NYLB LAT1 LAT2 XCEN RCON TSCL LSCL MSCL
 LCON MCON DUM1 DUM2 DUM3 DUM4 DUM5 IDC IDM /
 CH04 INT INT INT INT REAL REAL REAL REAL REAL
 REAL REAL REAL INT INT INT INT REAL REAL INT
 REAL REAL INT REAL REAL REAL REAL REAL REAL REAL
 REAL REAL REAL REAL REAL REAL REAL TIME TIME /
 1 1 1 1 1 1 1 1 1 1
 1 1 1 1 1 1 1 1 1 1
 1 1 1 1 1 1 1 1 1 1
 1 1 1 1 1 1 1 1 1 /
 "PLOTTING DEVICE         "
 "MIN HORIZONTAL RASTER   "
 "MIN VERTICAL RASTER     "
 "MAX HORIZONTAL RASTER   "
 "MAX VERTICAL RASTER     "
 "HORIZ RASTER / DEG LONG."
 "VERT RASTER  / DEG LAT. "
 "LONG AT HORIZ RASTER = 0"
 "LAT  AT VERT  RASTER = 0"
 "MIN LONG IN WINDOW (DEG)"
 "MIN LAT  IN WINDOW (DEG)"
 "MAX LONG IN WINDOW (DEG)"
 "MAX LAT  IN WINDOW (DEG)"
 "MINIMUM I IN WINDOW     "
 "MINIMUM J IN WINDOW     "
 "MAXIMUM I IN WINDOW     "
 "MAXIMUM J IN WINDOW     "
 "1ST LABELLED LONG. (DEG)"
 "DELTA LABELLED LONG(DEG)"
 "NUMBER OF LABELLED LONGS"
 "1ST LABELLED LAT   (DEG)"
 "DELTA LABELLED LAT (DEG)"
 "NUMBER OF LABELLED LATS."
 "1ST ZERO DISTORTION LAT "
 "2ND ZERO DISTORTION LAT "
 "CENTRAL LONGITUDE       "
 "DEG FR YMAX TO PROJ POLE"
 "ANGULAR SCALE (DEG/LONG)"
 "LAMBERT LON SCALE FACTOR"
 "LAMBERT LAT SCALE FACTOR"
 "LAMBERT LON CONSTANT    "
 "LAMBERT LAT CONSTANT    "
 "DUMMY NOT USED YET      "
 "DUMMY NOT USED YET      "
 "DUMMY NOT USED YET      "
 "DUMMY NOT USED YET      "
 "DUMMY NOT USED YET      "
```

```
 "RECORD CREATION DATE     "
 "RECORD MODIFICATION DATE" /
 /
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0 -5 -5 /
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0 /
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0 /
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0 /
 /
;
;    DEFINE GEOM STRUCTURE
;
ADD TSTR GEOM 3 0 16 "COORD TRANSFMTN          "
 ID NI NJ NK NL XMAX XMIN YMAX YMIN AL
 DX IDEL JDEL X0 IDC IDM /
 CH04 INT INT INT INT REAL REAL REAL REAL REAL
 REAL INT INT REAL TIME TIME /
 1 1 1 1 1 1 1 1 1 5
 3 8 8 3 1 1 /
 "ID = GEOM                "
 "NUMBER OF LONGITUDES     "
 "NUMBER OF LATITUDES      "
 "NUMBER OF AGLS           "
 "NUMBER OF DIRECTIONS     "
 "MAXIMUM LONGITUDE        "
 "MINIMUM LONGITUDE        "
 "MAXIMUM LATITUDE         "
 "MINIMUM LATITUDE         "
 "STATESPACE ALTITUDES (M)"
 "STATESPACE DELTS (DEG,M)"
 "DELTA I (LTH DIRECTION) "
 "DELTA J (LTH DIRECTION) "
 "STATESPACE ORIGIN(DEG,M)"
 "RECORD CREATION DATE     "
 "RECORD MODIFICATION DATE" /
 /
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0 -5 -5 /
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0 /
 0  0  0  0  0  0  0  0  0  0
```

```
 0  0  0  0  0  0 /
 0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0 /
 /
;
;    DEFINE LLTR STRUCTURE
;
ADD TSTR LLTR 101 200 7 "LLTR NODE PARAMETERS     "
 ID X CLNG ITYP ICON IDC IDM /
 CH08 REAL REAL INT CH08 TIME TIME /
 1 2 1 1 3 1 1 /
 "ID OF TRANSIT ROUTE NODE"
 "LONG-LAT OF LLTR NODE   "
 "TRANSIT ROUTE CEILING   "
 "TRANSIT ROUTE TYPE      "
 "LLTR NODE CONNECTIONS   "
 "RECORD CREATION DATE    "
 "RECORD MODIFICATION DATE" /
 /
 0 0 0 0 0 -5 -5 /
 0 0 0 0 0 0 0 /
 A 0 0 -999 A 0 0 /
 ZZZZZZZZ 360 99999 999 ZZZZZZZZ 999999 999999 /
 900 301 900 900 900 301 301 /
;
;    DEFINE NODP STRUCTURE
;
ADD TSTR NODP 3 250 9 "NODE PARAMETERS          "
 ID NSB NTR NTG NTR1 NTR2 NTR3 IDC IDM /
 CR04 INT INT INT INT INT INT TIME TIME /
 1 1 1 1 1 1 1 1 1 /
 "ID = NODP               "
 "NUMBER OF STAGING BASES "
 "NUMBER OF LLTR NODES    "
 "NUMBER OF TARGETS       "
 "NBR OF LLTR ENTRY NODES "
 "  OF LLTR INTERMED NODES"
 "NBR OF LLTR EXIT NODES  "
 "RECORD CREATION DATE    "
 "RECORD MODIFICATION DATE" /
 /
 0 0 0 0 0 0 0 -5 -5 /
 0 0 0 0 0 0 0 0 0 /
 A 0 0 0 0 0 0 0 0 /
 ZZZZ 999 999 999 999 999 999 999999 999999 /
 900 301 301 301 301 301 301 301 301 /
;
;    DEFINE PBOR STRUCTURE
;
ADD TSTR PBOR 51 600 5 "POLITICAL BORDERS        "
 ID NPTS XPB IDC IDM /
 CH08 INT REAL TIME TIME /
```

```
 1 1 200 1 1 /
 "ID OF POLITICAL BORDERS "
 "NBR OF PBOR BOUNDARY PTS"
 "LONG-LAT OF BNDRY POINTS"
 "RECORD CREATION DATE    "
 "RECORD MODIFICATION DATE" /
 /
 0 0 0 -5 -5 /
 0 0 0 0 0 /
 0 0 0 0 0 /
 ZZZZZZZZ 1009 360 999999 999999 /
 301 301 301 301 301 /
;
;     DEFINE ROZ STRUCTURE
;
ADD TSTR ROZ 11 600 7 "RESTRICTED OPERATNG ZONE"
 ID NPTS X TON TOFF IDC IDM /
 CH08 INT REAL REAL REAL TIME TIME /
 1 1 20 1 1 1 1 /
 "ID OF ROZ               "
 "NBR OF ROZ BOUNDARY PTS "
 "LONG-LAT OF BNDRY POINTS"
 "TIME ON OF ROZ          "
 "TIME OFF OF ROZ         "
 "RECORD CREATION DATE    "
 "RECORD MODIFICATION DATE" /
 /
 0 0 0 0 0 -5 -5 /
 0 0 0 0 0 0 0 /
 A 0 0 0 0 0 0 /
 ZZZZ 99 360 9999 9999 999999 999999 /
 301 301 301 301 301 301 301 /
;
;     DEFINE SPED STRUCTURE
;
ADD TSTR SPED 51 600 12 "SORTIE RECORDS          "
 ID ISB ITG PS PTH DFLT TTOT TOT NPT COOR
 IDC IDM /
 CH12 INT INT REAL REAL REAL REAL REAL INT REAL
 TIME TIME /
 1 1 1 1 1 1 1 1 1 720
 1 1 /
 "SORTIE ID (USER CHOOSEN)"
 "STAGING BASE INDEX      "
 "TARGET INDEX            "
 "PROB OF SURVIVAL        "
 "PROB KILL DUE TO THREATS"
 "DISTANCE                "
 "TAKE OFF TIME           "
 "TIME ON TARGET          "
 "  OF COORDS IN PATH     "
 "T,X,Y,A,HEADING,NODE    "
```

```
 "RECORD CREATION DATE    "
 "RECORD MODIFICATION DATE" /
 /
 0  0  0  0  0  0  0  0  0  0
 0  0  /
 0  0  0  1  1  1  1  1  0  0
 0  0  /
 0  0  0  0  0  0  0  0  0  0
 0  0  /
 0  0  0  1  1  99999.9  24  24  120  0
 0  0  /
 /
;
;     DEFINE STCH STRUCTURE
;
ADD TSTR STCH 201 100 11 "STOCHASTIC REGIONS       "
 ID ITYP XSC EXNT PEX RUNC NBPS XPBS FGRD IDC
 IDM /
 CH04 CH08 REAL REAL REAL REAL INT REAL REAL TIME
 TIME /
 1 1 3 1 1 1 1 100 1 1
 1 /
 "THREAT ID                "
 "THREAT TYPE NAME         "
 "THREAT LON,LAT, _ALT    "
 "EXPECTED   OF THREATS   "
 "PROB THREAT EXISTS       "
 "RADIUS OF UNCERTAINTY   "
 "  OF PTS ON STCH BORDER "
 "LON _LAT OF NTH POINT  "
 "RATIO OF INT/GEO GRID   "
 "RECORD CREATION DATE    "
 "RECORD MODIFICATION DATE" /
 /
 0  0  0  0  0  0  0  0  0  -5
 -5 /
 0  0  1  1  1  1  1  1  1  0
 0 /
 A  A  -180  0.0000  0  0.0  -180  0.0  0
 0 /
 ZZZZ  ZZZZZZZZ  180  3000.0  999.0  999.9  50  180  1.0 0
 0 /
 201 201 201 201 201 201 201 201 201 201
 201  /
;
;     DEFINE STGB STRUCTURE
;
ADD TSTR STGB 14 200 7 "STAGING BASE PARAMETERS "
 ID X ITYP NACR NWEP IDC IDM /
 CH08 REAL CH04 INT INT TIME TIME /
 1 2 1 1 10 1 1 /
 "ID OF STAGING BASE      "
```

```
  "LONG-LAT OF STAGING BASE"
  "TYPE OF AIRCRAFT AT BASE"
  "NUMBER OF AIRCRAFT      "
  "NUMBER OF WEAPONS       "
  "RECORD CREATION DATE    "
  "RECORD MODIFICATION DATE" /
  /
  0 0 0 0 0 -5 -5 /
  0 0 0 0 0 0 0 /
  A 0 A 0 0 0 0 /
  ZZZZ 360 ZZZZ 999 999 999999 999999 /
  900 301 301 900 900 301 301 /
;
;     DEFINE SUPM STRUCTURE
;
ADD TSTR SUPM 5 100 7 "SUPPRESSION MODEL        "
   ID RAD ICAP TYPE DEGR IDC IDM /
   CH08 REAL INT CH08 REAL TIME TIME /
   1 1 1 25 25 1 1 /
   "SUPP MODEL IDENTIFIER   "
   "MAX RADIUS OF THE SUPPRE"
   "SUPP CAPACITY           "
   "LIST THRT TYPE EFFECTIVE"
   "DEGRADE THRT CAPACITY   "
   "DATE SUPP MODEL CREATED "
   "DATE SUPP MODEL MODIFIED" /
   /
   0 0 0 0 0 -5 -5 /
   0 0 0 0 0 0 0 /
   AAAA  0.0  0  AAAA  0.0  0  0 /
   ZZZZ  9999. 9999 ZZZZ 1.0 9999 9999 /
   200 900 900 900 900 900 900 /
;
;     DEFINE SUPP STRUCTURE
;
ADD TSTR SUPP 11 100 5 "SUPPRESSOR TYPE          "
   ID TYPE XSU IDC IDM /
   CH08 CH08 REAL TIME TIME /
   1 1 3 1 1 /
   "SUPPRESSOR IDENTIFIER   "
   "SUPPRESSOR TYPE         "
   "LONG,LAT,TERR CLEAR ALT "
   "DATE SUPP REC CREATED   "
   "DATE MODIFICATION       " /
   /
   0 0 0 -5 -5 /
   0 1 1 0 0 /
   AAAA AAAA -9999. 0 0 /
   ZZZZ ZZZZ  9999.. 9999 9999 /
   201 900 900 900 900 /
;
;     DEFINE SWCH STRUCTURE
```

```
;
ADD TSTR SWCH 3 100 28 "VARIOUS SWITCHES         "
  ID IAOP IARP IBYT ICLB ICVB IDCN IDUL IEND IFES
  IGDS IGLD IMSK IPCS IREQ IRST JRST IRUF ISPD ISRD
  ITAV ISHK ICAV IDM1 IDM2 IDM3 IDC IDM /
  CH04 INT INT INT INT INT INT INT INT INT
  INT INT INT INT INT INT INT INT INT INT
  INT INT INT INT INT INT TIME TIME /
  1 1 1 1 1 1 1 1 1 1
  1 1 1 1 1 1 1 1 1 1
  1 1 1 1 1 1 1 1 /
  "ID                      "
  "ALTITUDE OPTIMIZATION   "
  "ARRAY PROCESSOR:1ON,0OFF"
  "BYTE PACKED TERRAIN     "
  "CLOBBER                 "
  "CL MODEL:0=BERMAN,1=GD  "
  "DECONFLICTION           "
  "DUAL CONTROL:0=Y,1,2=NO "
  "END POINTS OF ARCS      "
  "INFEASIBLE TRANSITIONS  "
  "GD RUN                  "
  "G LOAD:0=NO,1=YES       "
  "MASKING  (- = GD APPROX)"
  "CONST PROB OF CLOBBER   "
  "REQUANTIZATION          "
  "RESTART ARCS            "
  "RESTART TARCS           "
  "ROUGHNESS FILE          "
  "WRITE SPED FILE:YES R NO"
  "LOOK AT ALL STATE SPACE "
  "TARGET AVOID            "
  "SHRINK ACCESS BOX       "
  "LABEL DISPLAYS (SECRET) "
  "DUMMY NOT USED YET      "
  "DUMMY NOT USED YET      "
  "DUMMY NOT USED YET      "
  "RECORD CREATION DATE    "
  "RECORD MODIFICATION DATE" /
  /
  0  0  0  0  0  0  0  0  0  0
  0  0  0  0  0  0  0  0  0  0
  0  0  0 -5 -5 -5 -5 -5 /
  0  1  1  1  1  1  1  1  1  1
  1  1  1  1  1  1  1  1  1  1
  1  1  1  0  0  0  0  0 /
  0  0  0  0  0  0  0  0  0  0
  0  0  0  0  0  0 -1 -1  0  0
  0  0  0  0 /
  0  1  1  80  1  1  2  2  2  1
  2  1  4  1  1  1  1  1  1  1
  1  1  3  0  0  0  0  0 /
```

```
  200 200 900 200 200 200 400 900 900 900
  900 900 900 900 900 900 200 200 900 900
  900 900 900 900  /
;
;     DEFINE TG STRUCTURE
;
ADD TSTR TG 51 200 8 "TARGET PARAMS          "
 ID XTG CLAS IPRI ITYP PDMN IDC IDM /
 CH08 REAL CH04 INT INT REAL TIME TIME /
 1 2 1 1 1 1 1 1 /
 "TARGET ID                "
 "LONG-LAT OF TARGET       "
 "CLASSIFICATION OF TARGET"
 "TARGET PRIORITY          "
 "TYPE OF TARGET           "
 "MIN PROB DAMAG THRES TAR"
 "RECORD CREATION DATE     "
 "RECORD MODIFICATION DATE" /
 /
 0  0  0  0  0  0 -5 -5 /
 0  0  0  0  0  0  0  0 /
 A  0  A  0  1  0  0  0 /
 ZZZZ 999999 ZZZZ 9999 9999 999999 0 0 /
 301 900 900 900 900 900 900 900   /
;
;     DEFINE THRT STRUCTURE
;
ADD TSTR THRT 501 100 6 "THREAT LOCATIONS        "
 ID ITYP XTH PEX IDC IDM /
 CH04 CH08 REAL REAL TIME TIME /
 1 1 3 1 1 1 /
 "THREAT ID                "
 "THREAT TYPE              "
 "GEOD LON,LAT,ELE OF DEF "
 "PROBABILTY THREAT EXISTS"
 "RECORD CREATION DATE     "
 "RECORD MODIFICATION DATE" /
 /
 0  0  0  0  -5  -5 /
 0  0  1  1  0  0 /
 A  A  -180 0.0  0  0 /
 ZZZZ  ZZZZ  180  999.0  0  0 /
 201 201 201 201 900 900 /
;
;     DEFINE TMDL STRUCTURE
;
ADD TSTR TMDL 22 100 19 "THREAT MODELS           "
  ID RMAX DMIN NDRG NCRG DRG1 CRG1 DDRG DCRG PLOG
  DUM1 DUM2 DUM3 DUM4 DUM5 HIGH FLOR IDC IDM  /
  CH08 REAL REAL INT INT REAL REAL REAL REAL REAL
  REAL REAL REAL REAL REAL REAL REAL TIME TIME /
  1 1 1 1 1 1 1 1 1 200
```

```
     1 1 1 1 1 1 1 1 1 /
     "SPECIFIC THREAT MODEL ID"
     "MAXIMUM RANGE OF THREAT "
     "MIN LOG-PROB INSIDE RMAX"
     "NUMBER OF DOWNRANGE PTS "
     "NUMBER OF CROSSRANGE PTS"
     "1ST DOWNRANGE PT (NM)   "
     "1ST CROSSRANGE PT (NM)  "
     "DELTA DOWNRANGE (NM)    "
     "DELTA CROSSRANGE (NM)   "
     "PLOG AT  NTH CROSSRANGE "
     "DUMMY NOT USED YET      "
     "DUMMY NOT USED YET      "
     "DUMMY NOT USED YET      "
     "DUMMY NOT USED YET      "
     "DUMMY NOT USED YET      "
     "MAX THREAT HEIGHT       "
     "MIN THREAT DEPRES. HT   " /
     "RECORD CREATION DATE    "
     "RECORD MODIFICATION DATE"
     /
     0  0  0  0  0  0  0  0  0  0
     -5 -5 -5 -5 -5 0  0 -5 -5  /
     0  1  0  0  0  0  0  0  0  0
     0  0  0  0  0  0  0  0  0 /
     A  0.0  0.0  0  0  0.0  0.0 0.0 0.0 0.0
     0  0  0  0  0  0.0 0 0 /
     99999999  500.0  0  0  0  0  0  0  0  0
     0  0  0  0  0  0  0  0  0 /
     /
;
;  DEFINE VEHP STRUCTURE
;
 ADD TSTR VEHP 10 0 14 "VEHICLE PARAMETERS       "
  ID VNOM CLM DIV FCAP FCEG FCIN NMFC ISCL RCS
  TRAD TYP IDC IDM /
  CH04 REAL REAL REAL REAL REAL REAL INT INT REAL
  REAL CH04 TIME TIME /
  1 1 1 1 2 2 20 1 20 8
  1 1 1 1 /
  "AIRCRAFT ID             "
  "AIRCRAFT VELOCITY (NM/S)"
  "MAX CLIMB RATE (M/S)    "
  "MAX DIVE RATE (M/S)     "
  "FUEL CAPACITY (POUNDS)  "
  "EGR FUEL CONSUMP. ( /S) "
  "INGR FUEL CONSUMP. ( /S)"
  "NUMBER OF FUEL CONFIGS. "
  "STD. CONFIGURATION LOAD "
  "RADAR CROSS SECTIONS    "
  "MAX TURN RADIUS (M)     "
  "AIRCRAFT TYPE           "
```

```
 "RECORD CREATION DATE     "
 "RECORD MODIFICATION DATE" /
 /
 0 0 0 0 0 0 0 0 0 0
 0 0 -5 -5 /
 1 1 1 1 1 1 1 1 1 1
 1 1 1 1 /
 A 0 0 0 0 0 0 0 0 -9999
 0 A 0 0 /
 ZZZZ 9999 9999 9999 9999 9999 9999 9999 9999 9999
 9999 ZZZZ 99999 99999 /
 /
;
;    DEFINE WEAP STRUCTURE
;
ADD TSTR WEAP 5 400 6 "WEAPON PARAMETERS        "
 IDWP PDWP NMTY NAME IDC IDM /
 CH04 REAL INT CH08 TIME TIME /
 1 250 1 10 1 1 /
 "ID = WEAP                "
 "PK WEAP BY TG TYPE       "
 "NUMBER OF WEAP TYPES     "
 "NAME OF WEAPON           "
 "RECORD CREATION DATE     "
 "RECORD MODIFICATION DATE" /
 /
 0 0 0 0 -5 -5 /
 0 0 0 0 0 0 /
 A 0 0 0 0 /
 ZZZZ 1 9999 ZZZZ 9999 9999 /
 /
;
;    DEFINE WFZ STRUCTURES
;
ADD TSTR WFZ 12 600 5 "WEAPON FREE ZONE        "
 ID NPTS X IDC IDM /
 CH08 INT REAL TIME TIME /
 1 1 20 1 1 /
 "ID OF WEAPON FREE ZONE   "
 "NUMBER OF BOUNDARY POINT"
 "LONG-LAT OF WFZ BNDRY PT"
 "RECORD CREATION DATE     "
 "RECORD MODIFICATION DATE" /
 /
 0 0 0 -5 -5 /
 0 0 0 0 0 /
 A 0 0 0 0 /
 ZZZZ 10 360 999999 999999 /
 500 301 301 301 301 301 /
;
;    INITIALIZE AND SHOW STRUCTURES
;
```

```
INIT
SHOW HELP
ABOR
;
```

C.2.3 The ZDEFAR Command File

The ZDEFAR.DAT command file will not normally be used by a someone running FLAPS. It is another initialization file.

The ZDEFAR command file defines the structure of the FLAPS arrays. The following is a sample of a ZDEFAR command file.

```
OPEN TSTR OLD TSTR.FIL  R
INIT
OPEN ASTR NEW ASTR.FIL  R/W
;
 ADD ASTR ALTG 4      "ALTITUDE ARRAY          "
 ADD ASTR ALTS 4      "ALTITUDE ARRAY          "
 ADD ASTR ARCS 4      "ARC WAYPOINT ARRAY      "
 ADD ASTR ARPE 4      "TARG INGRESS/EGRESS PERF"
 ADD ASTR CL3D 4      "CLOBBER MODEL FOR 3-D   "
 ADD ASTR ITGC 4      "TARG ACCESSIBLE TO STGB "
 ADD ASTR ITRC 4      "TREX ACCESSIBLE TO TREN "
 ADD ASTR MASK 4      "TERRAIN MASKING         "
 ADD ASTR NBOX 4      "LIST OF TG BOX CORNERS  "
 ADD ASTR NLIS 4      "LIST OF NODES           "
 ADD ASTR NPOS 4      "NODE POSITIONS          "
 ADD ASTR ROUT 4      "ROUT NODES DIST AND PERF"
 ADD ASTR STAT 20     "STATESPACE              "
 ADD ASTR SXPE 4      "STGB TO LLTR EXIT PERF  "
 ADD ASTR TGUS 4      "TARGET STATUS ARRAY     "
 ADD ASTR TH2D 4      "TWO-D THREAT DANGER     "
 ADD ASTR TH3D 4      "THREE-D THREAT DANGER   "
 ADD ASTR TOBS 200    "THREAT OBSERVABILITY    "
 ADD ASTR TRPE 4      "LLTR TREE PERFORMANCE   "
```

C.2.4 The ZOPEN Command File

The ZOPEN.DAT command file is an initialization file which opens all of the FLAPS files. It will not normally be used when running FLAPS.

The following is a sample ZOPEN command file.

```
;
;    NORMAL RUN
;
OPEN TSTR OLD TSTR.FIL  R
INIT
OPEN ASTR OLD ASTR.FIL  R
INIT
;
;   OPEN TABLES
;
OPEN ALGP NEW ALGP.FIL  R/W
OPEN CMDL NEW CMDL.FIL  R/W
OPEN CURR NEW CURR.FIL  R/W
OPEN DISP NEW DISP.FIL  R/W
OPEN GEOM NEW GEOM.FIL  R/W
OPEN LLTR NEW LLTR.FIL  R/W
OPEN NODP NEW NODP.FIL  R/W
OPEN PBOR NEW PBOR.FIL  R/W
OPEN ROZ NEW ROZ.FIL    R/W
OPEN SPED NEW SPED.FIL  R/W
OPEN STCH NEW STCH.FIL  R/W
OPEN STGB NEW STGB.FIL  R/W
OPEN SUPM NEW SUPM.FIL  R/W
OPEN SUPP NEW SUPP.FIL  R/W
OPEN SWCH NEW SWCH.FIL  R/W
OPEN TG NEW TG.FIL      R/W
OPEN THRT NEW THRT.FIL  R/W
OPEN TMDL NEW TMDL.FIL  R/W
OPEN VEHP NEW VEHP.FIL  R/W
OPEN WEAP NEW WEAP.FIL  R/W
OPEN WFZ NEW WFZ.FIL    R/W
;
;   OPEN ARRAYS
;
OPEN ALTG NEW ALTG.FIL  R/W
OPEN ALTS NEW ALTS.FIL  R/W
OPEN ARCS NEW ARCS.FIL  R/W
OPEN ARPE NEW ARPE.FIL  R/W
OPEN CL3D NEW CL3D.FIL  R/W
OPEN ITGC NEW ITGC.FIL  R/W
OPEN ITRC NEW ITRC.FIL  R/W
OPEN MASK NEW MASK.FIL  R/W
OPEN NBOX NEW NBOX.FIL  R/W
OPEN NLIS NEW NLIS.FIL  R/W
OPEN NPOS NEW NPOS.FIL  R/W
OPEN ROUT NEW ROUT.FIL  R/W
OPEN STAT NEW STAT.FIL  R/W
OPEN SXPE NEW SXPE.FIL  R/W
OPEN TGUS NEW TGUS.FIL  R/W
OPEN TH2D NEW TH2D.FIL  R/W
```

```
OPEN TH3D NEW TH3D.FIL  R/W
OPEN TOBS NEW TOBS.FIL  R/W
OPEN TRPE NEW TRPE.FIL  R/W
```

C.2.5 The ZINIT Command File

The ZINIT.DAT command file is not normally used during a FLAPS session. It initializes the data in all of the one record tables and arrays.

The following is a sample of a ZINIT command file.

```
;
; ADD ONE RECORD ARRAYS
;
ADD ALGP ALGP 2.5 2.5 9.0 16.0 48.0 52.0 3 8 2 F-4 5.0E-6 1.5E-4
60.1  152.4  304.8  0.0  0.0  -2.0 16.0 48.0 53.0 / /
;
ADD CURR CURR 0 0 0 0 0 A 0 0 0 0 "4115" 0 0 0 0 0 0 0 0 0 0 0 /
;
ADD SWCH SWCH 0 0 1 0 0 0 0 1 0 0 0 2 0 0 0 0 0 0 0 0 0 0 0
PROC /
;
; USE ALGP TO INITIALIZE GEOM
;
GEOM
```

C.2.6 The ZDEMO Command File

The ZDEMO.DAT command file initializes all of the multiple record tables (and arrays where appropriate). It is an initialization command file and therefore is not normally used during a FLAPS session.

The following is a sample ZDEMO command file.

```
;
; FILE TO ADD LLTR NETWORK
;
ADD LLTR N001  6.9378 50.4483 320  1 N002 /
ADD LLTR N002  7.4425 50.4498 320  2 N003 /
ADD LLTR N003  7.9900 50.7805 320  2 N004 /
ADD LLTR N004  8.5915 51.0297 320  2 N005 /
ADD LLTR N005  9.3785 51.1868 320  3 /
ADD LLTR N006  8.9770 50.9815 320  0 /
```

```
ADD LLTR N007  8.5125 50.9225 320  0 /
ADD LLTR N008  8.3538 50.8180 320  0 /
ADD LLTR N010  7.9017 50.4547 320  0 /
ADD LLTR N011  8.2757 50.5983 320  0 /
ADD LLTR N012  8.9202 50.8282 320  0 /
ADD LLTR N013  9.4997 51.0210 320  0 /
ADD LLTR N014  9.1385 50.8112 320  0 /
ADD LLTR N015  8.7125 50.6575 320  0 /
ADD LLTR N016  8.5040 50.5678 320  0 /
ADD LLTR N017  8.5043 50.4312 320  0 /
ADD LLTR N018  9.0455 50.6427 320  0 /
ADD LLTR N019  9.5968 50.7807 320  0 /
ADD LLTR N020  9.3957 50.6417 320  0 /
ADD LLTR N021  8.7817 50.4632 320  0 /
ADD LLTR N022  7.8698 50.3162 320  0 /
ADD LLTR N023  7.2070 50.0882 320  2 N002 N024 /
ADD LLTR N024  7.6533 50.1813 320  2 N025 /
ADD LLTR N025  8.4563 50.2405 320  2 N026 /
ADD LLTR N026  8.9728 50.2930 320  2 N027 /
ADD LLTR N027  9.1230 50.4962 320  2 N028 /
ADD LLTR N028  9.5605 50.5972 320  3 /
ADD LLTR N029  9.5283 50.3743 320  0 /
ADD LLTR N030  6.9525 49.8882 320  2 N023 /
ADD LLTR N031  7.0720 49.5928 320  1 N030 /
ADD LLTR S070 10.6342 49.7560 320  0 /
ADD LLTR S071 10.8725 50.0887 320  0 /
ADD LLTR S073 10.8048 49.7668 320  0 /
ADD LLTR S074 10.0163 49.5185 320  0 /
ADD LLTR S077  9.3660 49.3248 320  0 /
ADD LLTR S078  8.8665 49.2565 320  0 /
ADD LLTR S079  7.6542 49.2880 320  1 S080 /
ADD LLTR S080  8.1150 49.2047 320  2 S081 S112 /
ADD LLTR S081  8.9085 49.1382 320  2 S082 /
ADD LLTR S082  9.3097 49.1592 320  2 S085 /
ADD LLTR S083  9.9757 49.3012 320  0 /
ADD LLTR S084 10.3208 49.4438 320  0 /
ADD LLTR S085 10.0738 49.1372 320  2 S086 /
ADD LLTR S086 10.5082 49.3580 320  2 S091 /
ADD LLTR S087 11.0605 49.7112 320  0 /
ADD LLTR S088 11.5813 50.0980 320  0 /
ADD LLTR S089 11.5548 49.7602 320  0 /
ADD LLTR S090 11.3172 49.5242 320  0 /
ADD LLTR S091 11.2045 49.3985 320  2 S092 /
ADD LLTR S092 11.9140 49.7382 320  3 /
ADD LLTR S093 11.0708 49.3368 320  0 /
ADD LLTR S094 10.6817 49.2088 320  0 /
ADD LLTR S095  9.7490 49.0492 320  0 /
ADD LLTR S096  9.0707 49.0788 320  0 /
ADD LLTR S097  8.6872 49.0390 320  0 /
ADD LLTR S098  9.4423 48.9477 320  0 /
ADD LLTR S099 10.1288 48.9783 320  0 /
ADD LLTR S100 10.8548 49.0155 320  0 /
```

```
ADD LLTR S101 11.4657 49.2792 320  0 /
ADD LLTR S102 12.0052 49.5522 320  0 /
ADD LLTR S103 11.7370 49.1627 320  0 /
ADD LLTR S112  8.2528 48.9760 320  2 S113 /
ADD LLTR S113  8.3368 48.6590 320  1 S126 /
ADD LLTR S114  8.8417 48.6213 320  0 /
ADD LLTR S115  9.4502 48.6392 320  0 /
ADD LLTR S116 10.0242 48.6293 320  0 /
ADD LLTR S117 10.7493 48.7303 320  0 /
ADD LLTR S118 11.3268 48.8232 320  0 /
ADD LLTR S119 12.1222 49.1438 320  0 /
ADD LLTR S120 12.7012 49.3822 320  0 /
ADD LLTR S121 11.9315 48.9042 320  0 /
ADD LLTR S122 11.3923 48.5975 320  0 /
ADD LLTR S123 10.6955 48.5643 320  0 /
ADD LLTR S124  9.7680 48.5238 320  0 /
ADD LLTR S125  9.2963 48.3935 320  0 /
ADD LLTR S126  8.5155 48.3517 320  2 S127 /
ADD LLTR S127  8.9790 48.3557 320  2 S128 /
ADD LLTR S128  9.5508 48.3212 320  2 S129 /
ADD LLTR S129 10.3640 48.2665 320  2 S130 /
ADD LLTR S130 11.1328 48.4627 320  2 S131 /
ADD LLTR S131 11.7902 48.6482 320  2 S132 /
ADD LLTR S132 12.2192 48.9255 320  2 s133 /
ADD LLTR S133 12.8697 49.1843 320  3 /
ADD LLTR S134 13.0070 48.9877 320  0 /
ADD LLTR S135 12.5402 48.5510 320  0 /
ADD LLTR S136 11.6235 48.3253 320  0 /
ADD LLTR S137 12.1932 48.1695 320  0 /
;
;     DATA FILE TO READ IN ROZ INFORMATION
;
ADD ROZ T1ROZ1 8
 8.5807E+00 5.1252E+01 8.4132E+00 5.1652E+01
 8.6016E+00 5.1998E+01 9.3551E+00 5.2211E+01
 1.0171E+01 5.2024E+01 1.0255E+01 5.1732E+01
 9.8575E+00 5.1452E+01 9.4807E+00 5.1292E+01 / / /
;
ADD ROZ T1ROZ2 8
 8.7481E+00 5.0853E+01 9.1877E+00 5.0959E+01
 9.4598E+00 5.0840E+01 9.4598E+00 5.0666E+01
 8.9993E+00 5.0560E+01 8.4551E+00 5.0507E+01
 8.2876E+00 5.0626E+01 8.4760E+00 5.0746E+01 / / /
;
ADD ROZ T1ROZ3 5
 9.7947E+00 5.0200E+01 1.1009E+01 5.0001E+01
 1.1155E+01 4.9655E+01 9.7528E+00 4.9468E+01
 8.7900E+00 4.9708E+01 / / /
;
ADD ROZ T1ROZ4 6
 1.2034E+01 4.9442E+01 1.2265E+01 4.9255E+01
 1.1344E+01 4.8789E+01 1.0213E+01 4.8536E+01
```

```
 9.6063E+00 4.8723E+01 1.0758E+01 4.9095E+01 / / /
;
ADD ROZ T1ROZ5 4
 1.3018E+01 4.8936E+01 1.3499E+01 4.8563E+01
 1.2579E+01 4.8163E+01 1.1385E+01 4.8217E+01 / / /
;
; FILE TO ADD STAGING BASES
;
ADD STGB FAIRFORD -1.750  51.58333 F111   4 99 99 99 99 99 0 0 0 0 0
ADD STGB LAKENHTH  0.5833 52.40000 F111   2 99 99 99 99 99 0 0 0 0 0
ADD STGB MILDENHA  0.5000 52.36667 F111   2 99 99 99 99 99 0 0 0 0 0
ADD STGB BENTWATE  1.4167 52.13333 F-4    6 99 99 99 99 99 0 0 0 0 0
ADD STGB BITBURG   6.533  49.9667  F-4    2 99 99 99 99 99 0 0 0 0 0
ADD STGB SPANGDAH  6.667  49.933   F-4    2 99 99 99 99 99 0 0 0 0 0
ADD STGB HAHN      7.25   49.933   F-16   4  0 99 0 0 0 0 0 0 0 0
ADD STGB RAMSTEIN  7.5667 49.433   F-16   6 99 99 99 99 99 0 0 0 0 0
ADD STGB SEMBACH   7.8833 49.5     F-16   2 99 99 99 99 99 0 0 0 0 0
ADD STGB LAHR      7.933  48.3667  F-16  10 99 99 99 99 99 0 0 0 0 0
ADD STGB SOLLING   8.0833 48.7833  F-4    8 99 99 99 99 99 0 0 0 0 0
ADD STGB WIESBADN  8.33   50.05    F-4    2 99 99 99 99 99 0 0 0 0 0
;
;
;    MODIFY TARGET TABLE
;
ADD TG PANENSKY 13.9333 50.31667     OCA  1 2 .85
ADD TG ZOLLSCHN 12.1167 51.2667      OCA  2 3 .97
ADD TG PRESCHEN 14.65 51.65          OCA  3 1 .87
ADD TG CASLAV 15.3833 49.95          OCA  4 3 .95
ADD TG LEIPZIG 12.45 51.433          OCA  5 7 .99
ADD TG PRAGUE 14.2667 50.11667       OCA  6 7 .98
;
; FILE TO ADD VEHP DATA
;
ADD VEHP F111 0.133 22 35 50000 0 3.33 0
 4.36 0.0 4.17 4.72 4.72 0.0 0.0 0.0 0.0 0.0
 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
 1
 10 0 4 10 10 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0
 -2.2 -2.2 -2.2 -2.2 -2.2 -2.2 -2.2 -2.2
 120 F111 /
;
ADD VEHP F-4 0.133 22 35 16800 0 3.33 0
 4.17 4.44 4.17 4.72 3.89 0.00 0.00 0.00 0.00 0.00
 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
 1
 6 6 2 6 6 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0
 -2.2 -2.2 -2.2 -2.2 -2.2 -2.2 -2.2 -2.2
 120 F-4 /
;
ADD VEHP F-16 0.133 22 35 14500 0 1.67 0
```

```
 1.94 2.78 4.61 2.42 2.08 0.00 0.00 0.00 0.00 0.00
 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
 1
 4 6 2 4 4 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0
 -2.2 -2.2 -2.2 -2.2 -2.2 -2.2 -2.2 -2.2
 120 F-16 /
;
; FILE TO ADD WEAPONS PARAMETERS
;
ADD WEAP WEAP
.10  .0   .35  .12  .25  0 0 0 0 0
.08  .0   .30  .10  .20  0 0 0 0 0
.06  .0   .25  .08  .15  0 0 0 0 0
.04  .0   .22  .07  .12  0 0 0 0 0
.03  .0   .20  .06  .10  0 0 0 0 0
.08  .30  .30  .19  .25  0 0 0 0 0
.07  .26  .25  .17  .19  0 0 0 0 0
.05  .22  .20  .15  .13  0 0 0 0 0
.03  .18  .17  .13  .09  0 0 0 0 0
.02  .15  .14  .11  .07  0 0 0 0 0
.0   .28  .22  .0   .0   0 0 0 0 0
.0   .23  .17  .0   .0   0 0 0 0 0
.0   .20  .13  .0   .0   0 0 0 0 0
.0   .20  .11  .0   .0   0 0 0 0 0
.0   .20  .08  .0   .0   0 0 0 0 0 /
 5
 MARK-82 AGM-65 MARK-84 CBU-38 MARK-20 /
;
;
; FILE TO ADD WEAPONS FREE ZONES
;
ADD WFZ DUSLDORF 4 6.25 51.45 7.25 51.76667  7.6667 51.5 7.00 51.0833 /
ADD WFZ FRANKFRT 4 8.3833 50.11667 8.667 50.2333 9.0 50.0833 8.633 49.75 /
ADD WFZ STUTGART 3 9.0 49.0 9.5 48.8333 9.0 48.667 /
;
; DATA FILE TO ADD THREAT MODELS TO TMDL TABLE
;
     ADD TMDL SA-2B
20.0
0.0
6
1
0.0
0.0
4.0
0.0
0.0007  0.0005  0.00035  0.00030  0.00025  0.00020
0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
0.0  0.0  0.0  0.0   /
1.5240E+04
250.0  /
```

```
;
ADD TMDL SA-2F
31.0
0.0
9
1
0.0
0.0
3.875
0.0
0.0010  0.0007  0.0006  0.0005  0.0004  0.00035
0.00030  0.00025  0.00020
0.0  0.0  0.0  0.0  0.0  0.0
0.0  0.0  0.0  0.0  0.0  /
1.5240E+04
250.0  /
;
ADD TMDL SA-3
12.5
0.0000E+00
4
1
0.0
0.0
4.1667
0.0
0.001   0.0007   0.0003   0.0002   0.0   0.0
0.0     0.0      0.0      0.0      0.0   0.0
0.0     0.0      0.0      0.0
0.0     0.0      0.0      0.0    /
1.5240E+04
0.0  /
;
ADD TMDL SA-4
43.0
0.0
11
6
-43.0
0.0
8.6
8.6
0.0000  0.0004  0.0009  0.0012  0.0014
0.0016  0.0015  0.0009  0.0004  0.0002
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0007  0.0013  0.0017  0.0021
0.0022  0.0016  0.0009  0.0004  0.0001
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0009  0.0017  0.0026  0.0027
0.0021  0.0014  0.0008  0.0004  0.0001
```

```
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0001  0.0017  0.0029  0.0021
0.0015  0.0010  0.0007  0.0002  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0009  0.0010
0.0009  0.0006  0.0003  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000 /
1.5240E+04
250.0  /
;
ADD TMDL SA-6
18.5
0.0
11
6
-18.5
0.0
3.7
3.7
0.0000  0.0010  0.0020  0.0030  0.0035
0.0020  0.0010  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0015  0.0030  0.0050  0.0060
0.0040  0.0010  0.0005  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0010  0.0025  0.0050  0.0025
0.0010  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0005  0.0015  0.0030  0.0020
0.0005  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0015  0.0010
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000
0.0000  0.0000  0.0000  0.0000  0.0000 /
```

```
1.5240E+04
0.0000E+00 /
;
ADD TMDL SA-7
2.15
0.0
1
0
0.0
0.0
0.0
0.0
.002 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
/
1.5240E+04
0.0000E+00 /
;
ADD TMDL SA-8
9.0
0.0
7
4
-9.0
0.0
3.0
3.0
0.0  0.020  0.030  0.00   0.0  0.0  0.0
0.0  0.0    0.0    0.0
0.0  0.0    0.0    0.0    0.0  0.0  0.0  0.0  0.0
0.0  0.025  0.030  0.00   0.0  0.0  0.0
0.0  0.0    0.0    0.0
0.0  0.0    0.0    0.0    0.0  0.0  0.0  0.0  0.0
0.0  0.004  0.020  0.00   0.0  0.0  0.0
0.0  0.0    0.0    0.0
0.0  0.0    0.0    0.0    0.0  0.0  0.0  0.0  0.0
0.0  0.0    0.0    0.0    0.0  0.0  0.0
0.0  0.0    0.0    0.0     /
1.5240E+04
0.0000E+00 /
;
ADD TMDL SA-9
5.0
0.0
1
0
0.0
0.0
0.0
0.0
.003 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
/
```

```
1.5240E+04
0.0 /
;
ADD TMDL SA-11
18.5
0.0
11
6
-18.5
0.0
3.7
3.7
0.0  0.004  0.008  0.016  0.010  0.004  0.001
0.0  0.0    0.0    0.0
0.0  0.0    0.0    0.0  0.0  0.0  0.0  0.0  0.0
0.0  0.004  0.008  0.012  0.008  0.004  0.001
0.0  0.0    0.0    0.0
0.0  0.0    0.0    0.0  0.0  0.0  0.0  0.0  0.0
0.0  0.003  0.006  0.010  0.006  0.002  0.000
0.0  0.0    0.0    0.0
0.0  0.0    0.0  0.0  0.0  0.0  0.0  0.0
0.0  0.0    0.004  0.006  0.004   0.0  0.0
0.0  0.0    0.0    0.0
0.0  0.0    0.0    0.0  0.0  0.0  0.0  0.0  0.0
0.0  0.0    0.0    0.004  0.002   0.0  0.0
0.0  0.0    0.0    0.0
0.0  0.0    0.0    0.0  0.0  0.0  0.0  0.0  0.0
0.0  0.0    0.0    0.0  0.0  0.0  0.0
0.0  0.0    0.0    0.0     /
1.5240E+04
0.0000E+00 /
;
ADD TMDL ZSU-23-4
3.0
0.0
1
0
0.0
0.0
0.0
0.0
.005 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
/
1.5240E+04
0.0 /
;
ADD TMDL BARLOCK
44.4
0.0
1
0
0.0
```

```
0.0
0.0
0.0
.0002 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
/
1.5240E+04
0.0000E+00 /
;
ADD TMDL BIGBAR
44.4
0.0
1
0
0.0
0.0
0.0
0.0
.0002 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
/
1.5240E+04
0.0000E+00 /
;
ADD TMDL NYSAC
44.4
0.0
1
0
0.0
0.0
0.0
0.0
.0002 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
/
1.5240E+04
0.0000E+00 /
;
ADD TMDL SPONREST
42.81
0.0
1
0
0.0
0.0
0.0
0.0
.0002 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
/
1.5240E+04
0.0000E+00 /
;
ADD TMDL FLATFACE
42.81
```

```
0.0
1
0
0.0
0.0
0.0
0.0
.0002 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
/
1.5240E+04
0.0000E+00 /
;
ADD TMDL SQUATEYE
51.23
0.0
1
0
0.0
0.0
0.0
0.0
.0002 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
/
1.5240E+04
0.0000E+00 /
;
ADD TMDL FARMGATE
42.81
0.0
1
0
0.0
0.0
0.0
0.0
.0002 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
/
1.5240E+04
0.0000E+00 /
;
ADD TMDL TALLKING
47.62
0.0
1
0
0.0
0.0
0.0
0.0
.0002 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
/
1.5240E+04
```

```
0.0000E+00 /
;
ADD TMDL BACKNET
42.81
0.0
1
0
0.0
0.0
0.0
0.0
.0002 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
/
1.5240E+04
0.0000E+00 /
;
ADD TMDL SA-6CC
18.5
0.0
1
0
0.0
0.0
0.0
0.0
0.0030  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
/
1.5240E+04
0.0000E+00 /
;
ADD TMDL SA-8CC
9.0
0.0
1
0
0.0
0.0
0.0
0.0
0.022  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
/
1.5240E+04
0.0000E+00 /
;
; FILE TO ADD FIXED THREATS TO THRT TABLE
;
         ADD THRT S601
                 SA-6
            1.2082E+01 5.0615E+01 3.05
            1.0000E+00 /
;
         ADD THRT S602
```

```
            SA-6
        1.2197E+01 5.0427E+01 3.05
        1.0000E+00 /
;
      ADD THRT S603
            SA-6
        1.2293E+01 5.0264E+01 3.05
        1.0000E+00 /
;
      ADD THRT S604
            SA-6
        1.2440E+01 5.0107E+01 3.05
        1.0000E+00 /
;
      ADD THRT S605
            SA-6
        1.2840E+01 5.0226E+01 3.05
        1.0000E+00 /
;
      ADD THRT S606
            SA-6
        1.2660E+01 4.9740E+01 3.05
        1.0000E+00 /
;
      ADD THRT S607
            SA-6
        1.2938E+01 4.9391E+01 3.05
        1.0000E+00 /
;
      ADD THRT S608
            SA-6
        1.3310E+01 4.9270E+01 3.05
        1.0000E+00 /
;
      ADD THRT S609
            SA-6
        1.4013E+01 4.9159E+01 3.05
        1.0000E+00 /
;
      ADD THRT S610
            SA-6
        1.4560E+01 4.8863E+01 3.05
        1.0000E+00 /
;
      ADD THRT S611
            SA-6
        1.5204E+01 4.8838E+01 3.05
        1.0000E+00 /
;
      ADD THRT S612
            SA-6
        1.5849E+01 4.8782E+01 3.05
```

```
        1.0000E+00 /
;
    ADD THRT S613
            SA-6
        10.1000 50.7500 3.05
        1.0000E+00 /
;
    ADD THRT S614
            SA-6
        10.2000 50.6500 3.05
        1.0000E+00 /
;
    ADD THRT S615
            SA-6
        10.1500 50.800 3.05
        1.0000E+00 /
;
    ADD THRT S616
            SA-6
        10.1740 50.8967 3.05
        1.0000E+00 /
;
    ADD THRT S617
            SA-6
        10.2973 50.4333 3.05
        1.0000E+00 /
;
    ADD THRT S618
            SA-6
        10.2515 50.7138 3.05
        1.0000E+00 /
;
    ADD THRT S619
            SA-6
        10.7184 51.0000 3.05
        1.0000E+00 /
;
    ADD THRT S620
            SA-6
        10.8324 51.7534 3.05
        1.0000E+00 /
;
    ADD THRT S621
            SA-6
        10.8996 50.4023 3.05
        1.0000E+00 /
;
    ADD THRT S622
            SA-6
        11.0476 50.3843 3.05
        1.0000E+00 /
;
```

```
ADD THRT S623
         SA-6
     11.2339 50.4023 3.05
     1.0000E+00 /
;
ADD THRT S624
         SA-6
     11.5034 50.4145 3.05
     1.0000E+00 /
;
ADD THRT S625
         SA-6
     11.9971 50.4053 3.05
     1.0000E+00 /
;
ADD THRT S201
         SA-2B
     10.6602 51.9875 6.10
     1.0000E+00 /
;
ADD THRT S202
         SA-2B
     10.3127 51.5167 6.10
     1.0000E+00 /
;
ADD THRT S203
         SA-2B
     9.9872 51.3667 6.10
     1.0000E+00 /
;
ADD THRT S204
         SA-2B
     10.2003 51.1667 6.10
     1.0000E+00 /
;
ADD THRT S205
         SA-2B
     10.0354 50.9833 6.10
     1.0000E+00 /
;
ADD THRT S206
         SA-2B
     10.078 51.1967 6.10
     1.0000E+00 /
;
ADD THRT S207
         SA-2B
     10.0204 50.8333 6.10
     1.0000E+00 /
;
ADD THRT S208
         SA-2B
```

```
        10.0968 51.6167 6.10
        1.0000E+00 /
;
    ADD THRT S209
            SA-2B
        12.5093 49.9872 6.10
        1.0000E+00 /
;
    ADD THRT S210
            SA-2E
        13.0894 49.0252 6.10
        1.0000E+00 /
;
    ADD THRT S211
            SA-2F
        10.0301 50.9833 6.10
        1.0000E+00 /
;
    ADD THRT S212
            SA-2F
        10.0600 50.9167 6.10
        1.0000E+00 /
;
    ADD THRT S213
            SA-2F
        12.1433 50.3167 6.10
        1.0000E+00 /
;
    ADD THRT S214
            SA-2F
        13.0105 49.3333 6.10
        1.0000E+00 /
;
    ADD THRT S215
            SA-2F
        13.7603 48.5197 6.10
        1.0000E+00 /
;
    ADD THRT S216
            SA-2F
        11.5333 50.4023 6.10
        1.0000E+00 /
;
    ADD THRT S217
            SA-2F
        11.3901 51.8347 6.10
        1.0000E+00 /
;
    ADD THRT S218
            SA-2F
        12.1205 51.2501 6.10
        1.0000E+00 /
```

```
;
ADD THRT S219
          SA-2F
     12.6923 51.3067 6.10
     1.0000E+00 /
;
ADD THRT S220
          SA-2F
     15.3901 49.9420 6.10
     1.0000E+00 /
;
ADD THRT A001
          ZSU-23-4
     1.2850E+01 5.0245E+01 1.5
     1.0000E+00 /
;
ADD THRT A002
          ZSU-23-4
     1.2938E+01 5.0283E+01 1.5
     1.0000E+00 /
;
ADD THRT A003
          ZSU-23-4
     1.2235E+01 5.1319E+01 1.5
     1.0000E+00 /
;
ADD THRT A004
          ZSU-23-4
     1.2293E+01 5.1394E+01 1.5
     1.0000E+00 /
;
ADD THRT A005
          ZSU-23-4
     1.2410E+01 5.1287E+01 1.5
     1.0000E+00 /
;
ADD THRT A006
          ZSU-23-4
     1.2528E+01 5.1331E+01 1.5
     1.0000E+00 /
;
ADD THRT A007
           ZSU-23-4
     1.3593E+01 5.0327E+01 1.5
     1.0000E+00 /
;
ADD THRT A008
           ZSU-23-4
     10.1089 50.6167 1.5
     1.0000E+00 /
;
ADD THRT A009
```

```
            ZSU-23-4
      10.0600 51.0167 1.5
      1.0000E+00 /
;
ADD THRT A010
            ZSU-23-4
      10.0979 50.6245 1.5
      1.0000E+00 /
;
ADD THRT S401
            SA-4
      10.1074 50.6347 3.05
      1.0000E+00 /
;
ADD THRT S402
            SA-4
      10.6845 50.5324 3.05
      1.0000E+00 /
;
ADD THRT S403
            SA-4
      11.9874 50.5023 3.05
      1.0000E+00 /
;
ADD THRT S404
           SA-4
      10.8324 51.7430 3.05
      1.0000E+00 /
;
ADD THRT S405
           SA-4
      1.4530E+01 5.0182E+01 3.05
      1.0000E+00 /
;
ADD THRT S406
           SA-4
      14.2667 50.1742 3.05
      1.0000E+00 /
;
ADD THRT S407
           SA-4
      14.3057 49.1102 3.05
      1.0000E+00 /
;
ADD THRT S408
           SA-4
      14.7147 51.7034 3.05
      1.0000E+00 /
;
ADD THRT S409
           SA-4
      14.5478 51.8477 3.05
```

```
        1.0000E+00 /
;
    ADD THRT S410
              SA-4
        13.6034 50.3792 3.05
        1.0000E+00 /
;
    ADD THRT SE01
                 SQUATEYE
        1.2782E+01 5.0025E+01 30.5
        1.0000E+00 /
;
    ADD THRT SE02
                 SQUATEYE
        1.2332E+01 5.1294E+01 30.5
        1.0000E+00 /
;
    ADD THRT SE03
                 SQUATEYE
        1.2616E+01 5.0389E+01 30.5
        1.0000E+00 /
;
    ADD THRT SE04
                 SQUATEYE
        1.4413E+01 5.0031E+01 30.5
        1.0000E+00 /
;
    ADD THRT SE05
                 SQUATEYE
        1.5371E+01 4.9918E+01 30.5
        1.0000E+00 /
;
    ADD THRT SE06
                 TALLKING
        1.5556E+01 5.1545E+01 13.72
        1.0000E+00 /
;
    ADD THRT SE07
              BARLOCK
        15.4001 49.9520 6.1
        1.0000E+00 /
;
    ADD THRT SE08
              BACKNET
        14.2441 50.1201 3.05
        1.0000E+00 /
;
    ADD THRT SE09
              FARMGATE
        12.2032 51.8143 3.05
        1.0000E+00 /
;
```

```
ADD THRT SE10
          SPONREST
     14.9599 51.3348 3.05
     1.0000E+00 /
;
ADD THRT SE11
             SQUATEYE
     10.9136 51.8782 30.5
     1.0000E+00 /
;
ADD THRT SE12
             SQUATEYE
     10.2754 51.2543 30.5
     1.0000E+00 /
;
ADD THRT SE13
             TALLKING
     10.1784 50.6874 13.72
     1.0000E+00 /
;
ADD THRT SE14
          BARLOCK
     11.1997 50.5832 6.1
     1.0000E+00 /
;
ADD THRT SE15
          BACKNET
     13.0145 49.4872 3.05
     1.0000E+00 /
;
ADD THRT SE16
          FARMGATE
     13.8402 49.1854 3.05
     1.0000E+00 /
;
ADD THRT SE17
          SPONREST
     14.1432 48.7231 3.05
     1.0000E+00 /
;
ADD THRT S801
          SA-8
     1.5700E+01 4.8937E+01 3.05
     1.0000E+00 /
;
ADD THRT S802
          SA-8
     1.5500E+01 4.8883E+01 3.05
     1.0000E+00 /
;
ADD THRT S803
          SA-8
```

```
        1.5200E+01 4.9023E+01 3.05
        1.0000E+00 /
;
     ADD THRT S804
            SA-8
        10.1977 51.1170 3.05
        1.0000E+00 /
;
     ADD THRT S805
            SA-8
        10.2172 51.4798 3.05
        1.0000E+00 /
;
     ADD THRT S806
            SA-8
        10.8667 50.4025 3.05
        1.0000E+00 /
;
     ADD THRT S807
            SA-8
        10.3020 51.5267 3.05
        1.0000E+00 /
;
     ADD THRT S808
            SA-8
        10.7231 50.2032 3.05
        1.0000E+00 /
;
     ADD THRT S809
            SA-8
        10.5956 51.7833 3.05
        1.0000E+00 /
;
     ADD THRT S810
            SA-8
        10.8034 50.4503 3.05
        1.0000E+00 /
;
     ADD THRT S811
            SA-8
        10.9832 50.3982 3.05
        1.0000E+00 /
;
     ADD THRT S812
            SA-8
        11.3201 50.5203 3.05
        1.0000E+00 /
;
     ADD THRT S813
            SA-8
        12.1463 50.4972 3.05
        1.0000E+00 /
```

```
;
        ADD THRT S814
                   SA-8
              9.9034 50.7167 3.05
              1.0000E+00 /
;
        ADD THRT S815
                   SA-8
              12.1284 51.2599 3.05
              1.0000E+00 /
;
;  FILE TO ADD MOBILE SAM ENVELOPES
;
ADD  STCH  M601  SA-6CC  0.0  0.0  3.05
5  0.8  0.0  4
11.333  51.917
11.000  51.667
10.667  51.833
10.833  52.000 /
1.0 /
;
ADD  STCH  M602  SA-6CC  0.0  0.0  3.05
4  0.95  0.0  5
10.667  51.250
10.250  51.250
10.000  51.333
10.500  51.500
11.000  51.500 /
1.0 /
;
ADD  STCH  M603  SA-6CC  10.333 50.667 3.05
2  0.85   18.0  0
0.0  0.0  /
1.0 /
;
ADD  STCH  M604  SA-6CC  0.0  0.0  3.05
1  1.0  0.0  4
10.667 50.333
10.833 50.250
10.583 50.250
10.583 50.333 /
1.0 /
;
ADD  STCH  M605  SA-6CC  0.0  0.0  3.05
5  0.90  0.0  4
13.040 49.440
12.917 49.390
12.833 49.430
13.000 49.540 /
1.0 /
;
ADD  STCH  M801  SA-8CC  10.75 51.50 3.05
```

```
3  0.9  20.0  0
0.0  0.0  /
1.0 /
;
ADD  STCH  M802  SA-8CC  0.0  0.0  3.05
4  0.75  0.0  3
11.150  50.382
11.421  50.399
11.207  50.350
/
1.0 /
;
ADD  STCH  M803  SA-8CC  0.0  0.0  3.05
4  0.78  0.0  3
10.333 50.583
10.333 50.500
10.167 50.583 /
1.0 /
;
ADD  STCH  M804  SA-8CC  0.0  0.0  3.05
4  0.85  0.0  3
13.000 49.750
12.500 49.615
12.500 49.900 /
1.0 /
;
ADD  STCH  M805  SA-8CC  0.0  0.0  3.05
3  0.95  0.0  6
13.917 49.250
13.667 48.917
13.290 49.000
13.000 49.333
13.000 49.417
13.333 49.417 /
1.0 /
;
ADD  STCH  M806  SA-8CC  0.0  0.0  3.05
4  0.97  0.0  3
11.450 50.500
12.120 50.421
12.500 50.000 /
1.0 /
;
;  FILE TO ADD SUPRESSOR MODELS
;
ADD SUPM EF-111 35.0 12
 SA-2B SA-2F SA-3 SA-4 BARLOCK BIGBAR NYSAC SPONREST FLATFACE
                       SQUATEYE FARMGATE TALLKING BACKNET
                       BACKTRAP /
  0.9   0.9   0.9  0.9  0.9     0.9    0.9   0.9      0.9
                        0.9     0.9    0.9   0.9      0.9
                       /
```

```
;
ADD SUPM COMPCALL 40.0 20
 SA-2B SA-2F SA-3 SA-4 SA-11 ZSU-23-4 BARLOCK BIGBAR
                       NYSAC SPONREST FLATFACE
                       SQUATEYE FARMGATE TALLKING BACKNET
                       /
 0.8  0.8  0.8  0.8  0.8  0.8  0.8  0.8  0.8
 0.8  0.8  0.8  0.8  0.8  0.8  0.8  0.8  0.8  /
;
ADD SUPM WILDWEAS 15.0 6
SA-6CC SA-8CC /
0.8  0.8  /
;
;    ADD SUPP POSITIONS
;
ADD SUPP EF-1111 EF-111   11.992 49.908 2.0 /
ADD SUPP WILDWE1 WILDWEAS 12.348 49.947 2.0 /
ADD SUPP COMPCA1 COMPCALL 11.972 49.788 2.0 /
ADD SUPP EF-1112 EF-111    9.8365 50.946 2.0 /
ADD SUPP WILDWE2 WILDWEAS 10.109 50.933 2.0 /
ADD SUPP COMPCA2 COMPCALL  9.6482 50.946 2.0 /
;
;
;
;     DATA FILE TO READ IN PBOR INFORMATION
;
ADD PBOR AUSCZE 30 13.8333 48.7666 14.0000 48.7000 14.0667 48.6667
   14.0167 48.6333 14.1000 48.6000 14.3500 48.5500 14.5000 48.6167
   14.7167 48.5667 14.7167 48.6667 14.8000 48.7833 15.0000 48.7833
   15.0000 49.0333 15.1667 49.0000 15.1667 48.9500 15.3333 49.0000
   15.7667 48.8500 15.8667 48.8667 16.0000 48.7667 16.3667 48.7167
   16.4667 48.8000 16.9000 48.7167 16.9500 48.5167 16.8500 48.4333
   16.8500 48.3500 17.0000 48.1500 17.0833 48.1333 17.0833 48.0333
   17.1500 48.0167 17.2500 48.0167 17.2667 48.0000 /
;
ADD PBOR POLCZE 50 14.9833 51.0000 15.0333 51.0167 15.0500 51.1067
   15.0667 51.0167 15.1500 50.9833 15.1500 51.0167 15.1833 51.0167
   15.1833 50.9833 15.2500 51.0000 15.2500 50.9833 15.2833 50.9833
   15.3000 50.9667 15.2667 50.9333 15.3000 50.8667 15.3667 50.8333
   15.3667 50.7833 15.4000 50.7667 15.4500 50.8167 15.7000 50.7333
   15.8333 50.7500 15.8667 50.6667 16.0000 50.6833 16.0333 50.6333
   16.0000 50.6000 16.0667 50.6167 16.1000 50.6667 16.1667 50.6500
   16.2000 50.6333 16.2333 50.6667 16.3333 50.6667 16.4500 50.5833
   17.0000 50.2500 17.1000 50.4000 17.1500 50.3833 17.2000 50.3833
   17.2833 50.3167 17.3500 50.3167 17.3500 50.2667 17.4000 50.2833
   17.4333 50.2500 17.5000 50.2667 17.6000 50.2667 17.6833 50.3167
   17.7500 50.3000 17.7500 50.2000 17.6000 50.1667 17.6667 50.1000
   17.7333 50.1000 17.8333 49.9667 18.0000 50.0167 /
;
ADD PBOR WESGER 26 11.0000 50.3500 11.1167 50.3500 11.2500 50.2667
   11.2500 50.4833 11.3500 50.5333 11.5333 50.3833 11.9167 50.4167
   12.0000 50.3500 12.1333 50.3167 12.2833 50.0500 12.4333 50.0000
```

```
    12.5753 49.8833 12.3833 49.7500 12.8333 49.3333 13.0000 49.3167
    13.4167 49.0500 13.4167 49.0000 13.5000 48.9333 13.5000 48.9500
    13.8333 48.7667 13.7500 48.5167 13.0000 48.2500 12.9333 48.2000
    12.8833 48.2000 12.7500 48.1000 12.8667 48.0000 /
;
ADD PBOR EASGER 76 12.1500 50.3167 12.2167 50.3167 12.3333 50.1667
    12.3333 50.2333 12.5000 50.4000 12.8333 50.4667 12.9500 50.4000
    13.0000 50.4333 13.0500 50.5167 13.1667 50.5167 13.2167 50.5167
    13.2500 50.5833 13.3000 50.5667 13.4167 50.6333 13.4500 50.5833
    13.4667 50.6000 13.5000 50.6333 13.5166 50.7167 13.7833 50.7333
    13.8500 50.7333 13.8833 50.7500 13.9000 50.8000 14.0000 50.8167
    14.0500 50.8000 14.0833 50.8000 14.2167 50.8667 14.2167 50.9000
    14.3833 50.9000 14.4000 50.9333 14.3000 50.9667 14.3333 50.9667
    14.2833 50.9833 14.2667 51.0000 14.3000 51.0500 14.4167 51.0167
    14.5000 51.0500 14.5000 51.0167 14.5833 51.0000 14.6167 50.9667
    14.5833 50.9167 14.6500 50.9333 14.6167 50.8667 14.8000 50.8167
    14.8167 50.8667 14.9667 51.0000 15.0000 51.1667 15.0333 51.2833
    15.0000 51.3167 14.9833 51.4000 14.9667 51.4667 14.7167 51.5167
    14.7000 51.5500 14.7333 51.6167 14.7167 51.6667 14.6667 51.7333
    14.6667 51.8000 14.6333 51.8000 14.5833 51.8333 14.7000 51.9167
    14.7167 52.0000 14.7667 52.0667 14.6833 52.1000 14.6833 52.1333
    14.7000 52.1667 14.7000 52.2333 14.6000 52.2667 14.5333 52.3833
    14.5500 52.4333 14.6167 52.5000 14.6000 52.5333 14.6333 52.5833
    14.2167 52.8167 14.1333 52.8333 14.1667 52.8667 14.1333 52.9667
    14.2500 53.0000 /
;
ADD PBOR EASWES 100 11.5000 53.0000 11.5000 52.9333 11.2333 52.8833
    11.1167 52.9000 11.0000 52.9167 10.9167 52.8500 10.5833 52.8333
    10.6167 52.7167 10.9167 52.6167 10.9833 52.6167 10.9500 52.5500
    11.0167 52.5000 10.9333 52.4667 11.0667 52.3667 10.9833 52.3500
    11.0333 52.3000 11.0167 52.2833 11.0833 52.2333 11.0167 52.2000
    11.0667 52.1667 10.9500 52.1000 10.9667 52.0667 10.6667 52.0500
    10.5833 52.0000 10.6333 51.9580 10.6167 51.9167 10.6500 51.9000
    10.5833 51.8333 10.5833 51.7833 10.6667 51.7333 10.6833 51.6900
    10.7000 51.6500 10.6667 51.6167 10.6500 51.5833 10.6167 51.5833
    10.5333 51.5500 10.4333 51.5833 10.3667 51.5833 10.3500 51.5167
    10.3000 51.5167 10.2167 51.4667 10.2000 51.4833 10.1750 51.4500
    10.1580 51.4410 10.0833 51.4250 10.0750 51.4167 10.0500 51.4333
     9.9167 51.3667  9.9500 51.3333  9.9667 51.3000  9.9750 51.2833
    10.0000 51.2883 10.0667 51.2750 10.0667 51.2580 10.0833 51.2450
    10.1500 51.2333 10.2333 51.1833 10.2167 51.1250 10.0000 51.1500
    10.0833 51.1167 10.1950 51.1167 10.1500 51.0833 10.1667 51.0667
    10.2167 51.0333 10.1833 51.0000 10.1167 51.0167 10.0500 51.0167
    10.0250 50.9833 10.0500 50.9167  9.9667 50.9167 10.0500 50.8833
    10.0167 50.8333  9.9667 50.8333  9.9167 50.7833  9.9000 50.7167
     9.8833 50.6333  9.9667 50.6333 10.0000 50.7500 10.0667 50.6200
    10.0833 50.6167 10.0450 50.6167 10.0500 50.5167 10.1167 50.5667
    10.1833 50.5580 10.3333 50.5000 10.4167 50.4167 10.4167 50.3833
    10.4500 50.4000 10.5167 50.3500 10.5333 50.3667 10.6000 50.3333
    10.6167 50.2167 10.7167 50.2000 10.8333 50.2333 10.8333 50.2750
    10.7167 50.3250 10.7667 50.3667 10.8667 50.3910 10.9500 50.3833
    11.0000 50.3500 /
```

```
;
ADD PBOR BERLIN 38 13.5500 52.3833 13.5667 52.3667 13.6500 52.3667
   13.6500 52.3333 13.7500 52.4333 13.6167 52.4667 13.6500 52.5333
   13.5000 52.5833 13.5167 52.6333 13.4833 52.6667 13.4333 52.6333
   13.4000 52.6500 13.3667 52.6167 13.3167 52.6333 13.3000 52.6500
   13.2500 52.6167 13.2167 52.5833 13.1167 52.5833 13.1167 52.4667
   13.1167 52.4333 13.0833 52.4167 13.1333 52.4000 13.2333 52.4167
   13.2500 52.4000 13.2833 52.4167 13.3000 52.4000 13.3500 52.4333
   13.4167 52.3667 13.4333 52.4167 13.4667 52.3500 13.5500 52.3833
   13.4833 52.4500 13.4500 52.5000 13.3833 52.5167 13.3833 52.5500
   13.4000 52.5500 13.3500 52.5833 13.3667 52.6167 /
;
ADD PBOR NWWGER 82 7.2167 53.0000 7.1000 52.8500 7.0667 52.6333
    6.7667 52.6500 6.7333 52.5833 6.7667 52.5667 6.6833 52.5500
    6.7000 52.4833 6.7833 52.4667 6.8833 52.4500 6.9500 52.4333
    6.9833 52.4667 7.0500 52.4000 7.0833 52.3667 7.0333 52.2833
    7.0667 52.2333 7.0000 52.2333 6.9167 52.1667 6.8667 52.1000
    6.7667 52.1000 6.7500 52.0833 6.7000 52.0500 6.8333 51.9833
    6.7167 51.9000 6.6833 51.9167 6.4833 51.8500 6.3833 51.8833
    6.4000 51.8333 6.2667 51.8833 6.2000 51.8833 6.1833 51.9000
    6.1167 51.9000 6.1667 51.8500 6.0667 51.8667 5.9500 51.8333
    5.9833 51.7833 5.9500 51.7333 6.0500 51.7167 6.0333 51.6667
    6.1167 51.6500 6.1000 51.6000 6.2167 51.5167 6.2167 51.3667
    6.0667 51.2167 6.0833 51.1667 6.1667 51.1833 6.1667 51.1500
    5.9500 51.0333 5.9167 51.0667 5.8833 51.0500 5.9000 50.9833
    6.0333 50.9833 6.0167 50.9333 6.0833 50.9167 6.0667 50.8500
    6.0167 50.8500 6.0167 50.8000 5.9667 50.8000 6.0167 50.7500
    6.0333 50.7167 6.1000 50.7167 6.1667 50.6333 6.2667 50.6333
    6.1667 50.5500 6.2333 50.5000 6.3500 50.4833 6.3500 50.3833
    6.3833 50.3333 6.3167 50.3333 6.2833 50.2667 6.1667 50.2167
    6.1833 50.1833 6.1500 50.1833 6.1333 50.1333 6.1167 50.0667
    6.1833 49.9667 6.3167 49.8333 6.5333 49.8000 6.5333 49.7167
    6.4333 49.6667 6.3833 49.5667 6.3667 49.4667 /
;
ADD PBOR SWWGER 59 6.1333 50.1333 6.1167 50.1667 6.0333 50.1833
    5.9667 50.1667 5.9667 50.1333 5.9000 50.1167 5.8667 50.0500
    5.8167 50.0000 5.8000 49.9667 5.7333 49.9000 5.7833 49.8667
    5.7500 49.8000 5.8333 49.7167 5.8833 49.7000 5.8667 49.6833
    5.9000 49.6333 5.8500 49.6000 5.8000 49.5500 5.8667 49.5000
    5.9667 49.4833 6.0000 49.4500 6.0833 49.4667 6.1667 49.5000
    6.2833 49.5000 6.3667 49.4667 6.4167 49.4833 6.5500 49.4333
    6.5833 49.3833 6.5667 49.3500 6.6667 49.2833 6.7333 49.1667
    6.8500 49.1500 6.8500 49.2167 7.0333 49.2000 7.0500 49.1167
    7.0833 49.1500 7.2000 49.1167 7.2833 49.1167 7.3667 49.1667
    7.4333 49.1833 7.5000 49.1500 7.5667 49.0833 7.6333 49.0500
    7.8000 49.0667 7.8667 49.0333 7.9333 49.0500 8.2333 48.9667
    8.0833 48.8000 7.9667 48.7667 7.8333 48.6500 7.8000 48.5833
    7.7667 48.5000 7.7000 48.3833 7.7333 48.3167 7.6833 48.3000
    7.6333 48.2167 7.5667 48.1167 7.5667 48.0333 7.6000 48.0000 /
;
ADD PBOR FRBEAC 92 -2.0000 48.6667 -1.9833 48.6833 -1.8500 48.7167
   -1.8333 48.6833 -1.8667 48.6500 -1.8333 48.6167 -1.7667 48.6000
```

```
      -1.5833 48.6333 -1.3500 48.6333 -1.5000 48.8000 -1.5667 48.7333
      -1.6000 48.8333 -1.5500 48.9333 -1.6000 49.0833 -1.6000 49.2167
      -1.8000 49.3667 -1.8833 49.5333 -1.8500 49.6333 -1.9333 49.6667
      -1.9333 49.7333 -1.8333 49.7167 -1.8167 49.6833 -1.6833 49.6667
      -1.6167 49.6500 -1.4667 49.7000 -1.2667 49.7000 -1.2333 49.6167
      -1.3000 49.5667 -1.1667 49.4167 -1.1667 49.3667 -1.1000 49.3500
      -1.0833 49.3833 -0.9167 49.4000 -0.4167 49.3500 -0.2500 49.3000
       0.0000 49.3333  0.1333 49.4000  0.4000 49.4500  0.1000 49.4667
       0.0667 49.5333  0.1667 49.6833  0.6167 49.8667  0.9667 49.9167
       1.0833 49.9333  1.4500 50.1167  1.5333 50.2333  1.6500 50.2000
       1.5333 50.2833  1.5833 50.3667  1.6167 50.3833  1.5833 50.4000
       1.6000 50.5333  1.5667 50.7167  1.5833 50.8667  1.7833 50.9500
       2.3333 51.0500  2.3833 51.0333  3.1167 51.3167  3.5000 51.4167
       3.8667 51.3500  3.9667 51.4000  4.1500 51.3500  4.2333 51.3833
       4.0667 51.4167  3.9667 51.4500  3.9000 51.4000  3.8000 51.3833
       3.5833 51.4333  3.4333 51.5500  3.5667 51.6000  3.7000 51.6000
       3.9000 51.5333  4.0667 51.5000  4.1500 51.4333  4.3000 51.4667
       4.0667 51.5333  4.0000 51.5833  4.0667 51.6167  4.1667 51.6167
       4.1333 51.6167  4.1167 51.6500  4.2500 51.6333  4.3500 51.7000
       4.6333 51.7167  4.8500 51.7167  4.7667 51.7667  4.5333 51.7333
       4.0667 51.8333  4.0333 51.9667  4.3833 52.2167  4.5833 52.6333
       4.7667 52.9667 /
;
ADD PBOR AMSTER 30 4.7667 52.9667 4.7833 52.9667 4.8167 52.9167
       4.8833 52.9000 4.9667 52.9333 5.0333 52.9333 5.1167 52.8500
       5.1000 52.7667 5.1500 52.7333 5.2000 52.7500 5.3000 52.7333
       5.1667 52.6167 5.0167 52.6333 5.0833 52.5000 5.0833 52.4333
       5.0000 52.3667 5.1333 52.3667 5.1333 52.3833 5.4333 52.5167
       5.4500 52.5500 5.6500 52.6333 5.5833 52.6667 5.5833 52.7667
       5.6667 52.8333 5.7167 52.8500 5.5667 52.8500 5.4167 52.8667
       5.3500 52.9000 5.4167 52.9167 5.4000 53.0000 /
;
ADD PBOR FRBELG 70 5.8000 49.5500 5.7667 49.5667 5.7500 49.5500
       5.6500 49.5500 5.6167 49.5167 5.5667 49.5333 5.4667 49.5000
       5.4667 49.5500 5.4000 49.6167 5.3000 49.6167 5.3167 49.6500
       5.2500 49.7000 5.1667 49.7000 5.0833 49.7667 4.9833 49.8000
       4.8500 49.7833 4.8500 49.8500 4.8833 49.9167 4.8333 49.9500
       4.8000 49.9500 4.8500 50.1000 4.8833 50.0833 4.9000 50.1333
       4.8167 50.1667 4.6833 50.0667 4.6833 50.0000 4.5833 49.9833
       4.4500 49.9500 4.3000 49.9667 4.2000 49.9500 4.1333 49.9833
       4.1500 50.0500 4.2333 50.0833 4.2000 50.1333 4.1333 50.1333
       4.1500 50.2167 4.2167 50.2500 4.1667 50.2833 4.1667 50.2500
       4.1333 50.2500 4.1000 50.3167 4.0333 50.3667 3.9000 50.3333
       3.8333 50.3500 3.7500 50.3500 3.7167 50.3000 3.6500 50.3667
       3.6500 50.4667 3.6000 50.5000 3.5000 50.4833 3.5167 50.5333
       3.4667 50.5333 3.3667 50.4833 3.2833 50.5333 3.2667 50.6000
       3.2333 50.6667 3.2500 50.7000 3.2000 50.7000 3.1333 50.8000
       2.9333 50.7500 2.9000 50.6833 2.8333 50.7167 2.8000 50.7167
       2.7167 50.8167 2.6333 50.8167 2.5833 50.9167 2.6167 50.9500
       2.6000 50.9833 2.5667 51.0000 2.5500 51.1000 /
;
ADD PBOR BELNET 56 6.0167 50.7500 5.9667 50.7500 5.8833 50.7667
```

```
      5.8000 50.7500 5.7667 50.7833 5.6833 50.7500 5.6833 50.7833
      5.6500 50.8833 5.7500 50.9667 5.7167 50.9667 5.7667 51.0333
      5.7667 51.0667 5.8333 51.1000 5.8500 51.1500 5.7500 51.1500
      5.7500 51.1833 5.6500 51.1833 5.5667 51.2167 5.5500 51.2667
      5.5000 51.3000 5.4167 51.2667 5.3500 51.2833 5.2500 51.2667
      5.2500 51.3000 5.1333 51.3167 5.0500 51.4000 5.0833 51.4333
      5.0500 51.4667 5.0333 51.4833 4.9167 51.4000 4.8833 51.4167
      4.7833 51.4000 4.7667 51.4333 4.8333 51.4167 4.8333 51.4833
      4.7500 51.5000 4.6667 51.4333 4.5500 51.4167 4.5667 51.4833
      4.3833 51.4500 4.4333 51.3667 4.3333 51.3667 4.3333 51.3833
      4.2167 51.3833 4.2167 51.3500 4.0500 51.2500 4.0000 51.2500
      3.8833 51.2000 3.7833 51.2167 3.7833 51.2833 3.5833 51.3167
      3.5000 51.2833 3.5333 51.2500 3.4167 51.2500 3.3500 51.3167
      3.3667 51.3667 /
;
 ADD PBOR ENGLAN 75 -2.0000 50.6000 -1.9500 50.6000 -1.9500 50.6833
     -1.8833 50.7167 -1.7500 50.7167 -1.6833 50.7333 -1.6000 50.7000
     -1.5333 50.7500 -1.4000 50.7833 -1.3500 50.7833 -1.3167 50.8167
     -1.4833 50.9167 -1.4000 50.8833 -1.1500 50.7833 -1.0333 50.8000
     -0.9167 50.7833 -0.7833 50.7167 -0.7333 50.7833 -0.2833 50.8167
      0.2333 50.7333 0.3500 50.8167 0.6667 50.8667 0.7833 50.9333
      0.9833 50.9167 0.9833 51.0000 1.0667 51.0667 1.2000 51.0833
      1.3833 51.1500 1.3667 51.3333 1.4333 51.3167 1.4500 51.3833
      1.0333 51.3667 0.8833 51.3500 0.9500 51.3667 0.9000 51.4167
      0.7167 51.4667 0.4667 51.4833 0.4167 51.4500 0.4167 51.5000
      0.6500 51.5333 0.8000 51.5333 0.9500 51.6167 0.9333 51.7500
      0.7000 51.7333 0.8500 51.7333 0.9000 51.7833 1.0000 51.8000
      1.0333 51.7667 1.1167 51.7667 1.2833 51.8833 1.2500 51.9000
      1.2833 51.9500 1.3167 51.9500 1.5667 52.0833 1.6333 52.2000
      1.6500 52.2833 1.6833 52.3167 1.7333 52.3833 1.7667 52.4833
      1.7333 52.5833 1.7333 52.6167 1.7000 52.7167 1.6500 52.7667
      1.3167 52.9333 0.9667 52.9833 1.0333 52.9667 0.6833 52.9833
      0.5500 52.9667 0.4833 52.9500 0.4500 52.8500 0.3667 52.8000
      0.2167 52.8167 0.1667 52.8833 0.0000 52.9000 0.1333 53.0000 /
;
 ADD PBOR ISLEWI 15 -1.2833 50.7667 -1.2167 50.7333 -1.1167 50.7167
     -1.1000 50.7000 -1.0833 50.6833 -1.1667 50.6500 -1.1833 50.6000
     -1.3167 50.5833 -1.5333 50.6667 -1.6000 50.6500 -1.5333 50.7000
     -1.5000 50.7333 -1.3500 50.7500 -1.3167 50.7667 -1.2833 50.7667 /
;
```

C.2.7 The ZCONTNU Command File

The ZCONTNU.DAT (z-continue) command file is the command file that is normally read to begin a FLAPS session. It re-opens all of the data files from the last FLAPS session. This permits a user to continue from the point where they quit at the end of their last session. The ZCONTNU.DAT command file is

read automatically by FLAPS when a user answers "YES" to the prompt asking whether the previous FLAPS files should be read.

The following is a sample of a ZCONTNU command file.

```
;
;    NORMAL RUN
;
OPEN TSTR OLD TSTR.FIL  R
INIT
OPEN ASTR OLD ASTR.FIL  R
INIT
;
;   OPEN TABLES
;
OPEN ALGP OLD ALGP.FIL  R/W
OPEN CURR OLD CURR.FIL  R/W
OPEN CMDL OLD CMDL.FIL  SR
OPEN DISP OLD DISP.FIL  R/SW
OPEN GEOM OLD GEOM.FIL  R/SW
OPEN LLTR OLD LLTR.FIL  R/W
OPEN NODP OLD NODP.FIL  R/SW
OPEN PBOR OLD PBOR.FIL  R
OPEN ROZ OLD ROZ.FIL    R/W
OPEN SPED OLD SPED.FIL  R/SW
OPEN STCH OLD STCH.FIL  R/W
OPEN STGB OLD STGB.FIL  R/W
OPEN SUPM OLD SUPM.FIL  R/W
OPEN SUPP OLD SUPP.FIL  R/W
OPEN SWCH OLD SWCH.FIL  R/W
OPEN TG OLD TG.FIL      R/W
OPEN THRT OLD THRT.FIL  R/W
OPEN TMDL OLD TMDL.FIL  R/W
OPEN VEHP OLD VEHP.FIL  R/W
OPEN WEAP OLD WEAP.FIL  R/W
OPEN WFZ OLD WFZ.FIL    R/W
;
;   OPEN ARRAYS
;
OPEN ALTG OLD ALTG.FIL  SR/W
OPEN ALTS OLD ALTS.FIL  SR/W
OPEN ARCS OLD ARCS.FIL  R/SW
OPEN ARPE OLD ARPE.FIL  R/SW
OPEN CL3D OLD CL3D.FIL  SR/W
OPEN ITGC OLD ITGC.FIL  R/SW
OPEN ITRC OLD ITRC.FIL  R/SW
OPEN NBOX OLD NBOX.FIL  R/SW
OPEN NLIS OLD NLIS.FIL  R/SW
OPEN NPOS OLD NPOS.FIL  R/SW
OPEN ROUT OLD ROUT.FIL  R/SW
```

```
OPEN STAT OLD STAT.FIL  SR/W
OPEN SXPE OLD SXPE.FIL  R/SW
OPEN TGUS OLD TGUS.FIL  R/SW
OPEN TH2D OLD TH2D.FIL  SR/W
OPEN TH3D OLD TH3D.FIL  SR/W
OPEN TOBS OLD TOBS.FIL  SR/W
OPEN TRPE OLD TRPE.FIL  R/SW
;
;    TEMPORARY TERRAIN MASKED FILE
;
OPEN MASK OLD MASK.FIL  SR/W
;
;    OPEN BYTE PACKED TERRAIN DATA
;
OPEN BYTE OLD DRA1:[FLAPS.TEST]Z8E48N.ZOT  SR
PR GE
DB 5
;
```

END
FILMED
4-86
DTIC